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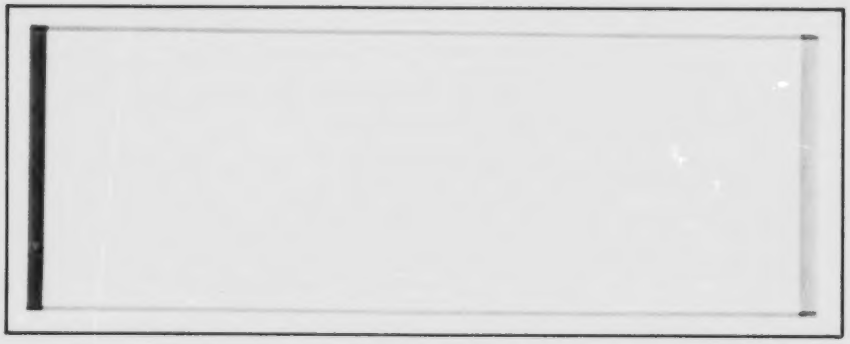

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THE INTERNATIONAL COMPETITIVE STATUS OF CANADA'S MILK PRODUCTION SECTOR

(Working Paper 1/89)

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International Comparison of the Competitive Status

of Canada's Milk Production Sector

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EXECUTIVE SUMMARY

Introduction

This study was undertaken to determine the relative productivity, efficiency and competitiveness of dairy producers in selected markets. This information has been prepared to assist policy makers estimate the potential impact of various international agriculture trade policies.

In this report the term productivity is used to describe the relationship among physical inputs and outputs. Efficiency refers to the cost of the various inputs required to produce a unit of output. Competitiveness is a measure of the relative efficiency of producers in different countries.

The objectives of this study are:

1. To compare the productivity of milk production in Canada with that of selected areas of Britain, the Netherlands, the United States and New Zealand.

2. To compare Canada's competitiveness as a supplier of milk for domestic and export processing with that of selected foreign countries.

Methodology

The approach taken to determining the competitiveness of the Canadian dairy production sector involved comparing data from representative samples of commercial milk producers in each of seven jurisdictions. Data were acquired from existing panels or studies in Ontario, Quebec, New Brunswick, the U.S. Upper Midwest, England, the Netherlands and New Zealand. These data assume typical or average technology mix from that area. Only random samples were utilized in the cross-country comparisons. Because the data from England related only to the milking herd, direct comparisons with all jurisdictions were not appropriate. The data from England is compared to equivalent data from Quebec in an appendix.

Production Systems Comparisons

Introduction

In order to summarize the comparison of the milk production systems, the productivity and efficiency of farmers in each area, a set of summary data have been consolidated in Table i. These data are averages for a sample of farmers from each geographic area. Since variance estimates were generally not available one should exercise caution when drawing conclusions regarding differences. In cases where the differences are large, such as equity, there is little doubt the very substantial differences are real.

Structure

The size of and level of investment in dairy farms differs substantially from country to country. As may be noted the three Canadian provinces and the Upper Midwest have relatively similar types of dairy operations due to the similarity of climate and crops produced. The Netherlands system is less land intensive, more oriented to purchased inputs and utilizes less labour. The New Zealand production system involves a large number of cows, low production per cow, a high degree of seasonality, minimal

Table 1. Comparison of Milk Production Systems

1985

Characteristics		New Brunswick	Ontario	Quebec	Netherlands	New Zealand	United States
1. Assets	$	615,417	726,581	434,754	507,926	444,688	434,433
2. Liabilities	$	104,407	135,189	119,492	131,093	109,527	172,839
3. Equity	$	511,009	591,393	315,262	376,833	335,160	261,597
4. Hectares operated	h	NA	107	112	26	76	172.70
5. Cows milked	#	51.4	42.5	36.0	55.1	127.5	45.0
6. Hectares/cow	h	NA	2.52	3.10	0.48	0.59	3.84
7. Total Milk Sales	hl	2,797	2,184	1,754	3,056	4,316	2,513.00
8. Milk Sales/cow	hl	54.4	51.4	48.7	55.5	33.9	55.84
9. Equivalent Sales/cow	hl	61	63	57	83	59	66
10. Value of milk sales	$	132,228	101,644	73,439	103,688	70,670	86,795
11. Revenue	$	154,384	138,341	113,303	135,549	91,750	118,434
12. Expenses	$	122,778	114,041	93,910	102,908	58,679	112,151
13. Net farm income	$	31,606	24,298	19,392	31,394	25,616	6,283
14. Net income/cow	$	615	572	539	570	201	140
15. Returns to dairy assets	%	6.65	3.68	5.46	7.73	6.15	1.30
16. Return to invest/management	%	6.18	4.11	6.15	8.33	7.64	2.40
17. Hours of labour	hr	4,753	4,556	3,847	4,059	3,990	5,800
18. Hours/hl.	hr	1.70	2.09	1.26	0.94	1.14	2.31
19. Value of labour	$	31,095	25,151	20,547	38,537	17,006	38,742
20. Labour cost/hl.	$	11.12	11.52	11.71	12.61	3.94	17.41
21. Cost of purchased feed/hl	$	13.71	4.75	7.68	11.96	0.61	5.86
22. Assets/hl	$	220.03	332.68	247.86	166.21	103.03	172.87
23. Cow opportunity cost/hl.	$	2.42	1.78	1.44	1.21	0.20	1.66
24. Total cost of milk/hl.	$	53.04	59.19	54.17	44.02	13.20	49.40
25. Total cost per Kg.BF	$	14.37	15.34	14.72	10.11	2.61	13.07
25. Index of average cost/hl.		116	130	119	97	29	109
26. Index of average cost/Kg.BF		123	131	126	86	22	112

feed purchases and low wage costs. In each case the producers have adapted their production system to the existing natural, economic and political environment.

The level of investment per dairy farms is highest in Ontario and lowest in Quebec and the Upper Midwest, $726,581 vs $434,754 and $434,433 respectively. The debt load of United States farmers at $172,839 was substantially higher than that of all the others. As a result, the equity in the United States farms of $261,597 was substantially less than the Ontario farmers with $591,393. New Brunswick farmers had an average equity just over $500,000 and all others ranged from $315,262 in Quebec to $376,833 in the Netherlands. A substantial part of the difference in equity is due to milk quotas which represented assets of $191,893 in Ontario, $125,003 in New Brunswick and $114,734 in Quebec.

The average number of cows milked per farm ranged from 36.0 in Quebec to 127.5 in New Zealand. Ontario and the Upper Midwest farms milked 42.5 and 45.0 cows, respectively, New Brunswick and the Netherlands had similar sized herds of 51.4 and 55.1 cows milked per farm.

Farm size ranged from 26.3 hectares in the Netherlands to 172.7 in the Upper Midwest. The New Zealand farms were 75.8 hectares compared to the Ontario and Quebec farms at 107.2 and 111.7 hectares, respectively. The size of the New Brunswick farms was not available.

Productivity

Productivity, an indicator of the physical inputs required to produce milk, was measured in terms of: production per cow; land utilized; and labour per hectolitre. Sales of milk per cow were relatively similar for five of the areas. Sales ranged from 55.8 hectolitres per cow per year in the Upper Midwest to 33.9 in New Zealand. The Netherlands' average sales were almost identical to those of the United States' farms. The three Canadian jurisdictions were: New Brunswick 54.4; Ontario 51.4 and Quebec 48.7 hl/yr.

When total dairy herd sales, which includes both milk and livestock on a milk equivalent basis, were considered the Netherlands farmers had sales of 83 hl/cow which were much higher than the others. Next highest was the United States at 66 followed closely by Ontario at 63, New Brunswick at 61, New Zealand at 59 and Quebec at 57 hl/cow/year. The Netherlands' sales of livestock may have been inflated by sales encouraged by the introduction of production quotas.

The hectares used per cow ranged from only .48 in the Netherlands and .59 in New Zealand to a high of 3.84 in the United States. Ontario used 2.52 and Quebec 3.10 hectares.

Labour spent producing a hectolitre of milk varied from a low of .94 hours in the Netherlands to a high of 2.31 in the United States. New Zealand and Quebec required 1.14 and 1.26 hours respectively while New Brunswick and Ontario required 1.70 and 2.09, respectively.

Efficiency

The efficiency of milk production, which is an indicator of the cost of the inputs required to produce a hectolitre of milk, was measured in terms of the cost of labour, the opportunity cost of equity, the cost of purchased feeds and the total costs of producing milk.

The cost of labour per hectolitre ranged from only $3.94 in New Zealand to $17.41 in the United States. The three Canadian provinces had relatively similar labour costs of $11.12 in New Brunswick, $11.52 in Ontario and $11.71 in Quebec. The cost of labour was $12.61 per hectolitre in the Netherlands.

The opportunity costs of investing in milk cows ranged from only $.20/hl in New Zealand to $2.42 in New Brunswick. The other locations were: the Netherlands $1.21; Quebec $1.44; United States $1.66 and Ontario $1.78 per hectolitre.

The cost of purchased feed, a measure of dependence on off-farm sources of feed, ranged from a low of $.61/hl in New Zealand to a high of $13.71 in New Brunswick. The costs in the other locations were: the Netherlands $11.96; Quebec $7.68; United States $9.58 and Ontario $4.75 per hectolitre.

The total cost of producing milk varied by a factor of 4.5 from $13.20/hl in New Zealand to $59.19 in Ontario. The Netherlands was second lowest at $44.02 followed by the United States at $49.40, New Brunswick at $53.04 and Quebec at $54.17/hl. The ranking was identical when the cost was calculated on the basis of kilograms of butterfat which is a more accurate measure given the variation in the butterfat test from location to location. The cost per Kg. of butterfat was as follows: Ontario $15.34; Quebec $14.72; New Brunswick $14.37; U.S. $13.07; Netherlands $10.11 and New Zealand $2.61. Each of these is expressed as an index of the unweighted average price in the study countries.

Profitability/Competitiveness

All of the efficiency measures above relate only to costs. When one also considers the net returns to milk production a slightly different pattern emerges. Net income per farm ranged from a high of $31,606 for New Brunswick and $31,394 for the Netherlands farmers to only $6,283 in the Upper Midwest sample of farmers. Average net farm incomes in the other three areas were: New Zealand $25,616; Ontario $24,298 and Quebec $19,392.

The net incomes per cow followed a different pattern: New Brunswick $615, Ontario $572, Netherlands $570, Quebec $539, New Zealand $201 and the Upper Midwest $140. The New Zealand farmers in 1985 were very competitive and because their herds were much larger than the others were receiving relatively good net returns per farm. The Upper Midwestern farmers were netting substantially lower returns both per cow and per farm than other milk producers.

Another way of illustrating the relative profitability of milk

production in the six areas is to compare the percentage return to dairy assets and to investment and management. The net return from the dairy enterprise to dairy assets was: Netherlands, 7.73%; New Brunswick, 6.65%; New Zealand, 6.15%; Quebec 5.46%; Ontario, 3.68%; and U.S., 1.3%. The net farm return to total investment and management has been calculated to be as follows: Netherlands 8.33%; New Zealand 7.64%; New Brunswick 6.18%; Quebec 6.15%; Ontario 4.11% and the Upper Midwest 2.4%. In all the cases the return is relatively low compared to non-agricultural activities.

Conclusions

1. In terms of milk sales and butterfat production Canadian farms are smaller than those in the Netherlands and New Zealand but similar to the U.S. farms studied.

2. Canadian factor inputs were generally less productive than those in the Netherlands and New Zealand.

3. Canadian milk production is significantly less competitive than the Netherlands or New Zealand and slightly less competitive than the U.S. Upper Midwest.

1.0 INTRODUCTION

1.1 Background

Major changes are occurring in international agriculture trade relations and policies. Both the recently completed bilateral Free Trade negotiations with the United States and the ongoing GATT negotiations have implications for Canadian agriculture. The relative productivity, efficiency and competitiveness of Canadian farmers is being questioned. Reliable information is required on each commodity sector in order to estimate the potential impact of alternative policies on producers.

1.2 Basic Concepts

The terms productivity and competitiveness are frequently used interchangeably in non-technical discussions. Throughout this report we will use the term productivity to describe the relationship among physical (technical) units of inputs and outputs. Efficiency will be measured as the physical quantity of output derived from inputs of a given value. Competitiveness in this study is a measure of the relative efficiency of producers across countries.

1.2.1 Productivity

Productivity is measured as physical quantities of output divided by physical quantities of inputs. There are two basic ways of conceptualizing productivity. One is multifactor or aggregate productivity which measures the effect of all inputs and the other is partial or factor productivity which measure productivity in terms of a single factor such as

labour, land or dairy cow unit.

Factor productivities are estimated by developing a production function which relates all inputs to a certain output. A partial productivity measure for a given input can be calculated by holding all the other inputs constant, and varying the one input. Production functions for agriculture are not often available and in practice it is not possible with survey data to vary one input while keeping others constant.

Partial productivity measures must be used cautiously. For example labour productivity may not be a reliable measure of output obtained from given resources. Changes in output per man hour may simply arise from changes in other inputs such as increases in fertilizer or machinery use. Partial measures of productivity seldom explicitly state that other factors of production have increased or decreased and, therefore, do not indicate the substitution of growth from one input to another.

Multifactor productivity refers to the ratio of total aggregate output to the total aggregate quantity of inputs used in production. It is clearly a measure of overall productivity and thus generally superior to a partial factor approach.

Multifactor productivity is, however, difficult to estimate due to the different units used to measure inputs, such as hectares of land, dollars of capital and hours of labour.

1.2.2 Efficiency

In our context, the concept of efficiency is similar to productivity but is defined as the change in total output per unit change in input costs. It too, requires a production function relating all inputs to one output. The physical amount of each input used to produce a given output is multiplied by its own price to establish its cost. Since each input is expressed in the same terms (money), total economic efficiency can be calculated as the costs of all inputs required to produce one unit of output.

1.2.3 Competitiveness

Competitiveness relates to our concept of efficiency. The most efficient production process would have the lowest cost per unit. Those producers with lowest cost possess an absolute advantage over competitors.

As defined above, competitiveness is not necessarily a consequence of high levels of productivity. Hypothetically, producers in one area could demonstrate superior performance in terms of all physical productivity measures but because their input factor prices were significantly higher than elsewhere they would have a lower level of competitiveness. Even though producers in one area are absolutely more productive in the technical sense, they may be less competitive.

1.2.4 Measurement Approaches

There are two distinct measurement approaches used in analyzing productivity. These involve the estimation of a single cross-country production function or the use of an input-output analysis approach. The strengths and limitations of each is outlined.

The use of production function methodology requires the specification and estimation of a cross-country production function. The advantage is that index number problems are eliminated by basing the productivity measure directly on the production function. Here changes in multifactor productivity are defined as shifts in the production function. Productivity changes may be measured through the change in the shift parameter in the production function over time.

This procedure is limited because the specified production functions may not accurately depict the production technology. The functions are difficult to specify and estimate. They often require the imposition of very restrictive assumptions. A critical assumption in this approach is that the technical possibilities available to dairy producers in all the countries under consideration are identical. In fact the data that are available reflect the influences of a multitude of factors such as economies of scale, allocative efficiency and quantities of inputs rather than simply "shifts" in the aggregate production function. Thus for practical purposes the production function approach is not suitable for directly measuring cross-country productivity within the context of this study.

While for practical purposes the use of a production function approach is not desirable, production theory provides a rationale for the input-output approach. A 1980 U.S.D.A. review of agricultural productivity measures explained how the theory helps in determining an appropriate method of aggregating inputs. They found that arithmetic aggregation with factor prices as weights is consistent with production theory. This result provides a theoretical basis for employing an input-output methodology.

An input-output approach seeks to directly measure both the physical quantity and value of inputs as well as the physical quantity of outputs. The analysis employed in this study will be within an input-output accounting framework.

In measuring production inputs this approach takes into account all factors of production, both those provided by the farm sector including operator labour, livestock, building, machinery, etc. It also accounts for those purchased from the non-farm sector including building and machinery repairs, hired labour, purchased feed, seed, etc.

The most important limitation of this approach is the bias that develops over time due to changing relative factor prices and relative weightings of factor inputs. This is not a serious consideration when the time period under consideration is relatively short. A problem of wide year-to-year fluctuations in the volume of outputs also exists. This is not a major problem in Canada because the supply management system encourages relatively consistent year-to-year

production. In other jurisdictions it may be necessary to place observations in a broader temporal content.

1.3 Objectives

This study focuses on the dairy sector and its two primary objectives are:

1. To compare the productivity of milk production in Canada with that of selected areas of Britain, the Netherlands, the United States and New Zealand.

2. To compare Canada's competitiveness as a supplier of milk for domestic and export processing with that of selected foreign countries.

These comparisons were made by considering milk production costs and the support given to producers by government and consumers.

2.0 METHODOLOGY

2.1 Milk Production

2.1.1 Approach

Our approach to the comparison of productivity and competitiveness derives from the following operating principles:

* Data used as the basis for a comparison was collected from a sample of producers representative of the population of commercial milk producers within the study area.

* Comparisons are based upon the "typical" or average technology mix utilized to produce milk in each study area.

* The same definitions and analytical procedures are applied in a consistent manner, to each data base to the extent feasible.

These operating principles precluded the use of data from self-selected producer samples. Only randomly sampled data bases were used as primary data sources for cross-country comparisons. The adequacy of sample data varied from country to country as indicated in Appendix 1. Secondary sources were used to supplement survey data where required.

2.1.2 Data Collection

Data for the primary analysis of the dairy enterprise defined as the milk herd plus replacements were collected from New Brunswick, Ontario, Quebec, the Netherlands, United States (Upper Mid-West) and New Zealand. A secondary

analysis presented in Appendix 2 compares England and Wales with Quebec on a milk herd only basis.

2.1.3 Data Used in the Analysis

In our primary analysis on a Milk Herd plus replacement basis, the following data sources were identified as being consistent with the research consultant's operating principles:

A. New Brunswick

The New Brunswick Dairy Business Analysis Accounting Project (NBDAAP) a cooperative project of the New Brunswick Milk Marketing Board, the Canadian Dairy Commission and the New Brunswick Department of Agriculture.

B. Ontario

The Ontario Dairy Farm Accounting Project (ODFAP) is a joint undertaking of the Ontario Milk Marketing Board, Agriculture Canada, the Canadian Dairy Commission, the University of Guelph and the Ontario Ministry of Agriculture and Food.

C. Quebec

Survey completed by the Groupe de recherche en économie et politique agricoles, Université Laval (GREPA). The survey is a cooperative venture of the Canadian Dairy Commission, la Fédération des producteurs de lait du Québec and l'Université Laval.

D. Netherlands

Sample data was collected by the Landbouw-Economisch Institut (LEI) at the Hague. The institute is supported by the Dutch Ministry of Agriculture and Fisheries.

E. New Zealand

Sample data used in this study was collected by the Agricultural Research unit of Lincoln College, University of Canterbury and covers producers in South Auckland, the primary producing area in New Zealand. Refer to Appendix 1 for a comparison of producers in this area with New Zealand averages as reported by the New Zealand Milk Board.

F. United States

Data from their Farm Costs and Returns Survey were provided by the United States Department of Agriculture for the upper Midwest region which includes Michigan, Minnesota, Wisconsin and South Dakota.

In Appendix 2 the GREPA sample was used for Quebec on a Milk Herd only basis. This sample was compared with the following sample.

G. England and Wales

The National Investigation into the Economics of Milk Production in England and Wales (NIEMP) which is sponsored jointly by the Milk Marketing Board of England and Wales and the Ministry of Agriculture, Fisheries and Food in conjunction with various universities.

Sample characteristics are presented in Table 1.

The research consultant developed a detailed questionnaire which was completed by participating agencies in each location. Information on the following topics was elicited.

TABLE 1
Sample Characteristics

LOCALE	YEAR	ESTIMATED POPULATION	SAMPLE SIZE	MINIMUM ELIGIBILITY REQUIREMENT	SAMPLE LIMITATIONS
NEW BRUNSWICK (NBDAAP)	1985	508	32	Ship milk	NA
ONTARIO (ODFAP)	1985	10,504	131	Ship milk	Northern Ontario excluded (4.8% of Provincial shipments)
QUEBEC (GREPA)	1985	16,812	152	Ship milk	NA
NETHERLANDS (LEI)	1985-86	34,000	422	80% of Revenue from Milk Shipments LEI estimates few shippers in 60%-80% range	Quotas recently introduced
NEW ZEALAND (AER)	1984-85	404	31	-75% of Revenue from milk shipments -not a share milker	-Samples South Auckland only (Region has 46.2% of New Zealand milk shipments) -Share milkers representing 40% of the dairy population are excluded. -Town Milk shippers not included represent about 10% of dairy population
ENGLAND & WALES (NIEMP)	1985-86	38,437	348	-66% of Revenue from milk shipments -Minimum herd size 10 cows	-Quotas recently introduced -limited whole farm data
UNITED STATES	1985	273,620	2,200	-$1000 of Revenue from milk shipments	-Sample represents 85% of milk producers

a. Whole Farm Revenues and Expenses.
b. Whole Farm Assets and Liabilities.
c. Land Utilization.
d. Labour Utilization.
e. Feed Utilization.
f. Whole Farm production results.

Visits were made to each jurisdiction to examine the data collection procedures and analytical methods used for each data base. The survey questionnaire was reviewed with each participating agency to ensure consistency. The data obtained were converted to common measures suitable for cross-country comparison.

The degree to which respondents were able to directly assign expenses or assets to particular enterprises differed between jurisdictions because of data collection procedures. Where expenses and assets were not directly assigned to particular enterprises we allocated costs. Unassigned costs were allocated between enterprises on the basis of their contribution to total cash revenues. This is a common allocation procedure which assumes that costs associated with non-dairy enterprises are proportional to their contribution to farm revenues. The research consultants explored other allocation procedures but data limitations prevented their application.

2.1.4 Analysis of Production Data

All financial data were adjusted to smooth currency fluctuations. First the local currencies were converted to Special Drawing Rights (SDR) using a five year average exchange rate. These SDR rates were then converted to

Canadian dollars.

All assets were valued at current market rates. The research consultants have imputed an opportunity cost of employing dairy assets. The rate of return assigned was equal to the five year average real rate of return on long-term bonds in the local country.

In the analysis, we first present results for whole farm revenues, expenses, assets and liabilities. Results for the dairy enterprise defined as the milk herd plus replacements are then considered. Productivity and efficiency measures for major inputs are developed. We then aggregate direct revenues and expenses to obtain a calculation of net income on a cash cost basis. Opportunity costs of employing dairy assets and unpaid labour are then valued. Finally we estimate total production costs and total multifactor productivity for dairy enterprises in each jurisdiction by aggregating our cash valuation for all inputs including operator labour and employed assets. Returns to management are not directly considered.

3.0 RESULTS OF SELECTED WHOLE FARM COMPARISONS

In this section we explore the relative size and degree of specialization of dairy farms in the samples. From this analysis we can also identify appropriate allocation procedures.

3.1 Revenues and Expenses

The study areas were compared in terms of the costs and returns generated by the typical farm operation. Selected revenue and expense items are presented in Table 2. The dairy enterprise has been defined to include milk production plus the production of cow replacements for the milk herd. With few exceptions the production of replacements forms an integral part of the typical dairy operation in most countries.

New Brunswick farms were the largest in terms of revenues generated. Ontario and Dutch operations were of comparable size in revenue terms. New Zealand enterprises produced significantly less revenue than farms in other locations.

Direct milk sales were a significant component of revenues in all locales. Their contribution ranged from a high of 86% of total cash revenues in New Brunswick to a low of 66% in Quebec. In addition to direct sales, however, milk production generates revenues in the form of subsidies and rebates from shipments to cooperatives. The replacement enterprise typically produces sales from animals surplus to the requirements of the milk herd. When all related sales are considered the dairy enterprise contributed up to 99% of total farm cash revenues in New Brunswick and over 85% in Quebec.

TABLE 2

WHOLE FARM REVENUES & EXPENSES
1985

JURISDICTION	NEW BRUNSWICK	ONTARIO	QUEBEC	NETHER LANDS	NEW ZEALAND	U.S.UPPER MIDWEST
			REVENUES $CDN			
REVENUE/EXPENSE						
MILK SALES	132,228	101,644	73,439	103,688	70,670	86,795
DIRECT MILK SUBSIDY	6,557	7,811	8,420	0	0	0
OTHER MILK REVENUE	433	0	2,721	0	0	946
SUBTOTAL DAIRY PRODUCT SALES	139,218	109,455	84,580	103,688	70,670	87,741
DAIRY LIVESTOCK SALES	13,004	15,051	10,347	24,815	16,448	10,215
TOTAL DAIRY REVENUES	152,222	124,506	94,927	128,503	87,119	97,957
OTHER LIVESTOCK SALES	0	6,800	7,799	5,155	268	4,478
CROP SALES	1,041	5,870	4,869	1,050	206	10,887
FARM CUSTOM WORK	0	0	588	354	649	232
OTHER SALES	0	3,064	2,072	487	510	1,369
OTHER SUBSIDY	0	136	527	0	2,998	3,512
TOTAL CASH REVENUES	153,263	140,375	110,782	135,549	91,750	118,434
INVENTORY CHANGE	1,121	-2,034	2,521	-1,248	0	0
TOTAL FARM REVENUES	154,384	138,341	113,303	134,301	91,750	118,434
			EXPENSES			
DAIRY LIVESTOCK EXPENSE	65,214	34,577	34,866	46,350	12,088	25,626
OTHER LIVESTOCK EXPENSE	0	1,276	5,824	3,289	339	4,068
CROP EXPENSE	17,482	24,890	9,694	12,174	5,975	13,639
INDIRECT EXPENSES	29,349	40,006	31,881	30,874	32,822	56,971
INTEREST EXPENSE	6,493	12,347	9,826	9,494	10,529	18,094
LAND RENT	1,813	1,581	271	3,245	309	5,524
WAGES	12,851	8,433	3,924	1,903	5,294	9,742
LEVIES	0	0	8,570	0	0	0
TOTAL EXPENSE >DEPRECIATION	112,046	100,749	82,265	92,687	51,225	100,304
DEPRECIATION EXPENSE	10,732	13,295	11,645	10,220	7,455	11,847
TOTAL FARM EXPENSE	122,778	114,044	93,910	102,908	58,679	112,151
NFI >INV CHGE & DEPRE	41,217	39,626	28,516	42,862	33,071	18,130
NET FARM INCOME	31,606	24,298	19,392	31,394	25,616	6,283

Other Livestock and crop sales are generally low (less than 5% of revenues) except in Ontario (9%) and Quebec (11%) and the U.S. Midwest (13%). Direct milk subsidy was paid only in Canadian jurisdictions and ranged from 4.3% of total cash revenues in New Brunswick to 7.6% in Quebec.

Reported expenses in the whole farm context should be considered cautiously for a variety of reasons. Data collection procedures in some locales allowed researchers to directly allocate a larger proportion of expenses to dairy. Crop expense in some regions is incurred mainly in the production of feed for the dairy enterprise. In our analysis the dairy enterprise is assessed a share of these expenses. Later in this report we present revenue/expense and balance sheets specific to the dairy operation.

3.2 Assets and Liabilities

Selected whole farm balance sheet values may be found in Table 3. These data should also be interpreted with care. In many instances we do not know how a class of assets has been used nor are we able to determine why liabilities have been incurred. We can, however, make some observations on the basis of whole farm data. As expected these dairy farms have made significant investments in the major dairy inputs of cattle and land and in Canadian jurisdictions, milk quota.

Dairy cattle typically represent the major livestock input. New Brunswick farms have the largest investment in dairy cattle while Quebec operations have the smallest. Dairy cattle accounted for over 99% of investment in animal assets in New Brunswick and New Zealand. Quebec with over 92% of animal assets in dairy cattle was at the low end of the range.

While dairy cattle are the major livestock investment they are less significant as a proportion of total assets. This

TABLE 3

WHOLE FARM SELECTED BALANCE SHEET VALUES
(MARKET VALUATION)
1985

LOCATION	NEW BRUNSWICK	ONTARIO	QUEBEC	NETHER LANDS	NEW ZEALAND	U.S.UPPER MIDWEST
			SELECTED ASSET CATEGORIES $CDN			
ASSET						
DAIRY MILK HERD	83,947	45,478	31,026	51,979	44,087	46,641
MILK HERD REPLACEMENTS	38,093	24,734	14,553	22,076	12,714	15,289
SUB TOTAL DAIRY LIVESTOCK	122,040	70,212	45,579	74,054	56,801	61,929
TOTAL OTHER LIVESTOCK	522	4,307	3,889	2,046	374	789
SUB TOTAL ALL LIVESTOCK	122,562	74,518	49,467	76,100	57,175	62,718
MILK QUOTA	125,003	191,893	114,734	0	0	0
LAND	90,978	0	85,858	211,815	318,107	193,352
BUILDINGS	96,659	265,861	47,344	80,323	12,995	0
SUB TOTAL LAND & BUILDINGS	187,637	265,861	133,202	292,138	331,102	193,352
TOTAL ASSETS	615,417	726,581	434,754	507,926	444,688	434,433
			LIABILITY CATEGORY			
LIABILITY						
SHORT TERM LIABILITIES	11,063	26,683	12,053	9,181	10,964	
MEDIUM TERM LIABILITIES	12,984	40,385	107,439	121,912	27,216	
LONG TERM LIABILITIES	80,361	68,121	0	0	71,348	
TOTAL LIABILITIES	104,407	135,189	119,492	131,093	109,527	172,836
			OWNERS EQUITY			
OWNERS EQUITY	511,009	591,393	315,262	376,833	335,160	261,597

proportion approaches a high of about 20% of total assets in New Brunswick and a low of just under 9% in Ontario.

In Canadian jurisdictions dairy farmers hold more assets in the form of quota. In Ontario and Quebec quota represents more than 26% and in New Brunswick just over 20% of total assets. Quotas on milk production were introduced in the Netherlands in 1984 but are not traded. In 1985 the New Zealand Dairy Board instituted a moratorium on new sources of milk supply.

Land continues to be an important investment for dairy producers in all jurisdictions. In New Zealand land represents about 71% of total assets and in the Netherlands just under 42%. Investment in land in these locations is significantly higher than in Canadian jurisdictions. Land accounts for about 15% of total assets in New Brunswick and just under 20% in Quebec.

Liabilities as a percentage of total assets range from a low of 17% in New Brunswick to a high of 40% in the United States. In general short-term liabilities make up about 10% of total debt but this proportion is just under 20% in Ontario. Interest payments range from a low of about 6% of total expenses before depreciation in New Brunswick to a high of about 21% in New Zealand. In other locales interest payments are in the range of 10-12% of total expenses before depreciation.

Owners equity ranges from a low of 60% of total assets in the United States to a high of 83% in New Brunswick. In New Zealand and the Netherlands owners equity represents about 75% of assets. Owners equity is about 81% of total assets in Ontario operations.

4.0 RESULTS OF SELECTED DAIRY ENTERPRISE COMPARISONS

The comparison of whole farm financial data in the previous section may lead to inaccurate conclusions about the relative sizes of the dairy enterprises being compared. Revenues are influenced by price as well as quantity. In this section we minimize the effect of relative price differences between locales by considering physical measures of outputs and inputs.

4.1 Physical Output Measures

In Table 4, and Figures 1 and 2 sales of milk and butterfat are given by jurisdiction. Data on solid-not-fat production were not available for most of the samples and national butterfat figures had to be used for U.S. Upper Midwest analysis. Sales of cows culled from the milk or replacement herd are also presented as an output on a "milk equivalent" basis.

When physical output measures are considered, typical Canadian dairy operations prove to be smaller than their New Zealand or Dutch counterparts. Farm milk sales range from a low of 1754 hectolitres in Quebec to a high of 4316 hectolitres in New Zealand.

The butterfat content of milk produced in Ontario (3.86%) was marginally higher than in the U.S. Upper Midwest (3.78%), New Brunswick (3.69%) or Quebec (3.68%) but less than in New Zealand (5.05%) or the Netherlands (4.35%). These results accentuated differences between Canadian operations and Dutch and New Zealand enterprises when output was measured in terms of butterfat production. The typical New Brunswick farm produced on average 22% more butterfat than the average Ontario farm and almost 60% more than the Quebec average. The typical Dutch operation sold almost 30% more butterfat than a New Brunswick farm while the average New Zealand enterprise produced over twice as much.

TABLE 4

OUTPUT PER FARM
1985

LOCALE	Milk Sales (HL)	BF% Wt/Vol	Butterfat Sales (KG)	Livestock Sales (ME IN HL)	Total Output (HL)	HL 3.6% EQUIV. HL	TOTAL OUTPUT 3.6%BF (HL)
New Brunswick	2,797	3.69%	10,321	275	3,072	2,867	3,149
Ontario	2,184	3.86%	8,430	323	2,507	2,342	2,688
Quebec	1,754	3.68%	6,456	247	2,001	1,793	2,045
Netherlands	3,056	4.35%	13,310	731	3,787	3,692	4,576
New Zealand	4,316	5.05%	21,802	1,009	5,325	6,054	7,471
U.S. Upper MidWest	2,513	3.78%	9,499	296	2,809	2,639	2,949
ENGLAND & WALES	3,490	3.97%	13,855	NR	NA	3,849	NA

FIGURE 1
MILK SALES PER FARM

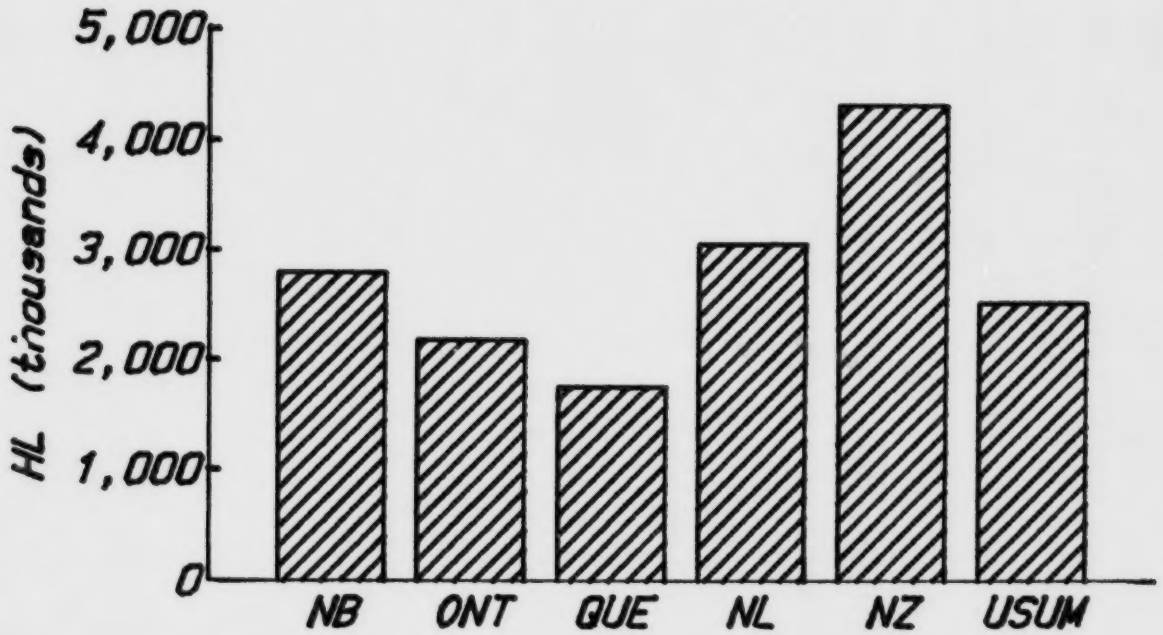
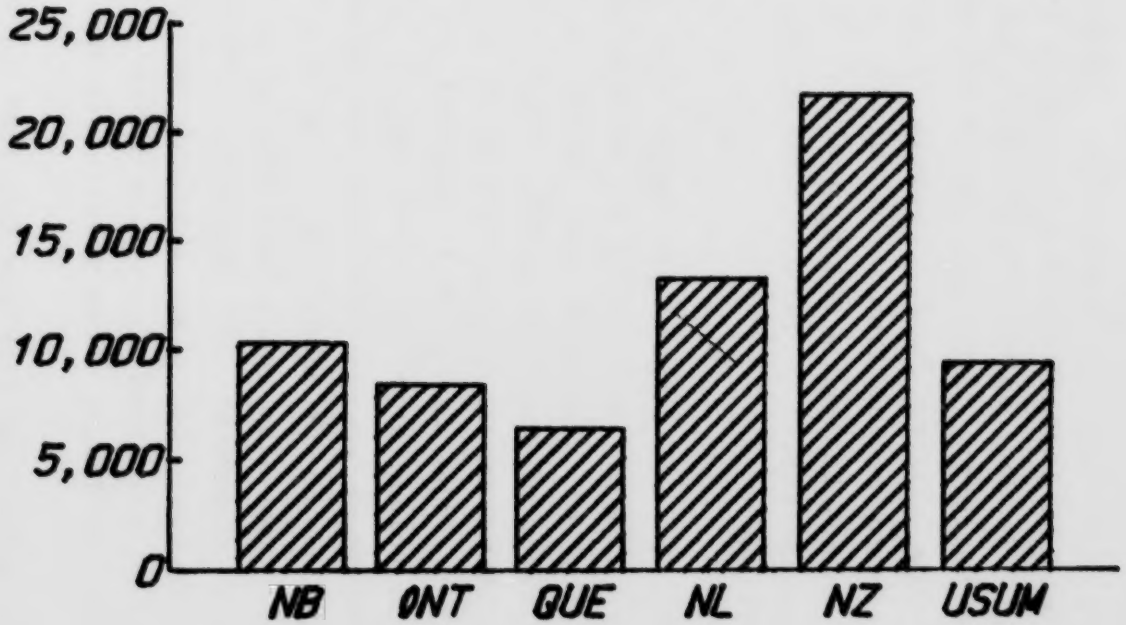


FIGURE 2
BUTTERFAT SALES PER FARM



4.2 Productivity of Selected Inputs

4.2.1 Cow Productivity

Average numbers of cows in the milking and replacement herd are displayed in Table 5 and Figures 3 and 4 respectively. Milk cows are defined as lactating and dry cows in the milking herd. We defined replacement cows as: open and bred heifers; dairy bulls and calves intended for the milking herd. Numbers of cows in the milk herd ranged from a low of 36 in Quebec to 128 in New Zealand. The typical New Zealand herd was substantially larger than those in other locations.

Measures of output per milk cow are often believed to reflect the underlying genetic quality of the herd and to be an important indicator of competitiveness. This belief has an intuitive appeal because the more milk produced per cow the fewer cows required to produce a given volume of milk. This implies less feed is being used to maintain cows and more is being utilized to produce milk. At a given output fewer cows also means less capital investment in cows, equipment and housing. Higher output levels may be also attained by inefficient feeding practices so caution should be exercised when considering these measures in isolation.

Milk sales per milk cow outlined in Table 5 and Figure 5 range from a low of 33.85 hectolitres in New Zealand to a high of 55.84 hectolitres in the Upper Midwestern United States. Average sales in the six jurisdictions was 49.95 hectolitres per milk cow. New Zealand milk production per cow is about 70% of this average. These results are not

TABLE 5

MEASURES OF COW PRODUCTIVITY
1985

LOCALE	NUMBER MILK COWS #	NUMBER REPLACE COWS #	SALES PER MILK COW MILK (HL)	BF (KG)	MEAT (HL)	TOTAL (HL)	3.6% MLK SALES PER MLK COW (HL/COW)
				------3.6% BF------			
New Brunswick	51.4	52.6	54.42	201	5	61	55.78
Ontario	42.5	41.0	51.44	199	8	63	55.15
Quebec	36.0	62.6	48.72	179	7	57	49.80
Netherlands	55.1	41.0	55.45	242	13	83	67.00
New Zealand	127.5	98.0	33.85	171	8	59	47.49
U.S. UpperMidWest	45.0	38.0	55.84	211	7	66	58.63

FIGURE 3
NUMBER OF MILK COWS

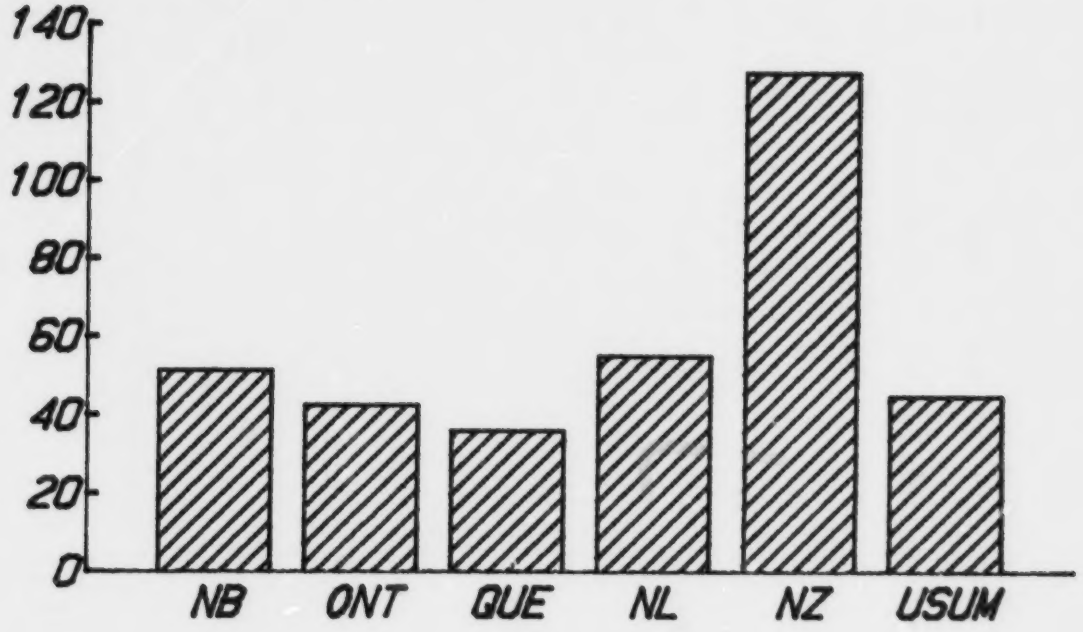


FIGURE 4
NUMBER OF REPLACEMENT COWS

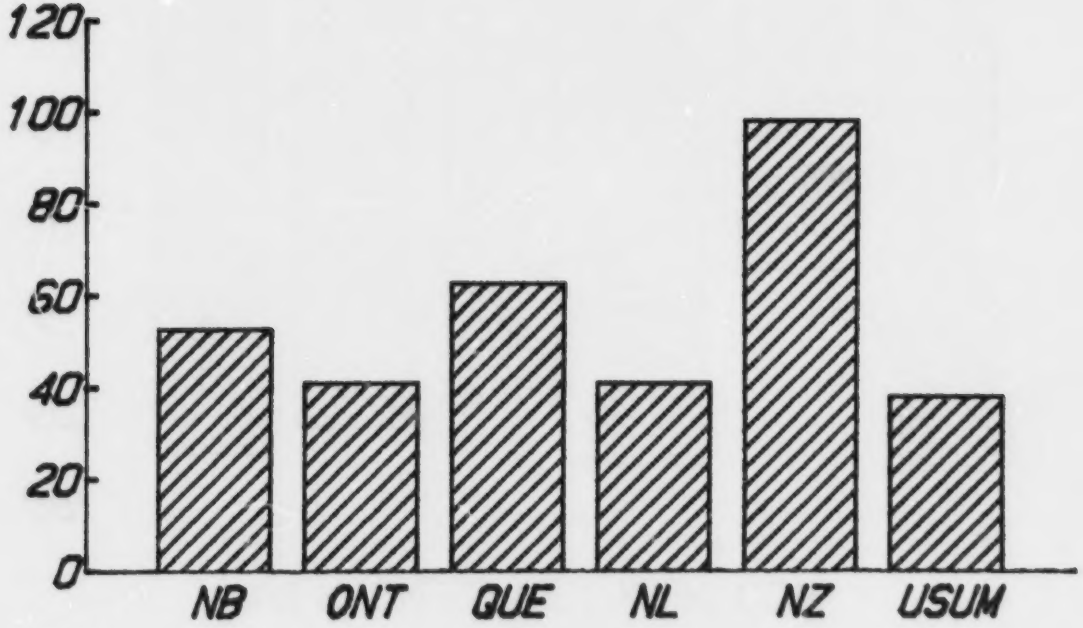


FIGURE 5
MILK SALES PER MILK COW

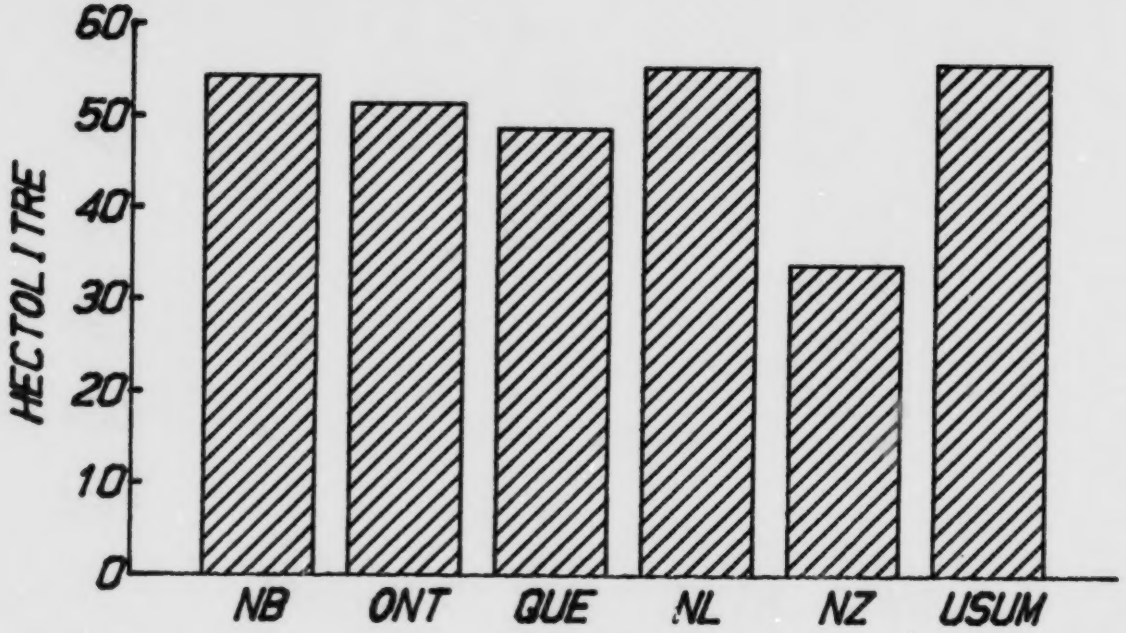
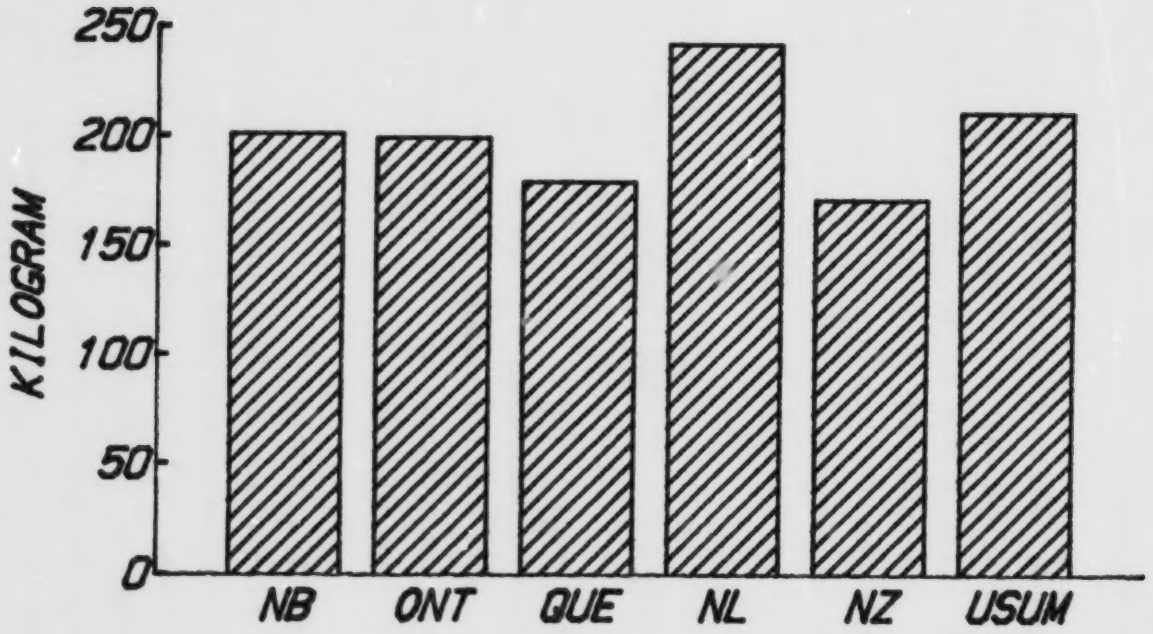


FIGURE 6
BUTTERFAT SALES PER MILK COW



of the milk.

Since fresh milk is not widely traded, the output of butterfat per cow is a more appropriate measure of productivity for international comparisons.

Average sales of butterfat per milk cow over all locales was 200.5 kilograms. Sales of butterfat per milking cow ranged from a low of 171 kg. in New Zealand to a very high 242 kg. in the Netherlands. Production levels per milk cow were about average in Ontario and New Brunswick but lower in Quebec. See Figure 6.

Meat sales per milk cow are not useful as a direct productivity measure. They are frequently only indicative of expansion or contraction of the milk herd. The Netherlands had a significantly higher level of meat sales per milk cow than other locales. Quotas on milk production were introduced in the Netherlands in 1984 and may have increased cull rates.

4.2.2 Land Utilization

A description of land utilization in the various locales is summarized in Table 6. Land operated includes all land used by the producer whether owned or rented. On the basis of reported cropping practices we have categorized cultivated land as being used for non-forage crops or forage crops. Non-forage crops include cash crops and wheat, oats, barley and grain corn which are considered to be concentrates when fed to the dairy herd. Forage crops include as hay, haylage and grass. Pasture land is grazed by the dairy herd but some forage may also have been harvested from these same lands. Rough grazing lands are

TABLE 6

LAND UTILIZATION IN HECTARES
1985

LOCALE	Land Operated	Non Forage	Forage Crops	Pasture	Rough Grazing	Other	REPORTED PASTURE YIELD T/HAY EQ	GRAZING REPORTED FEED CONTRIB KG/DM
New Brunswick	N/A	8.3	63.9	18.3	N/A	N/A	2.0	23,556
Ontario	107.2	45.2	38.8	10.2	5.5	7.5	2.1	4,822
Quebec	111.7	18.0	40.4	20.0	N/A	33.4	2.4	
Netherlands	26.3	2.2	0.1	24.0	0.0	0.0	NR	106,000
New Zealand	75.8	6.1	0.0	66.1	1.7	5.3	NR	
U.S. UpperMidWest	172.7	59.5	31.6	35.6	N/A	46.0		

	ESTIMATED FORAGE HECTARES	FORAGE HECTARES PER MLK COW
NEW BRUNSWICK	82.2	1.6
ONTARIO	54.5	1.3
QUEBEC	60.4	1.7
NETHERLANDS	24.1	0.4
NEW ZEALAND	67.9	0.5
U.S. UpperMidWest	67.2	1.5
ENGLAND&WALES	52.7	0.8

FIGURE 7
ESTIMATED HECTARES OF FORAGE PER FARM

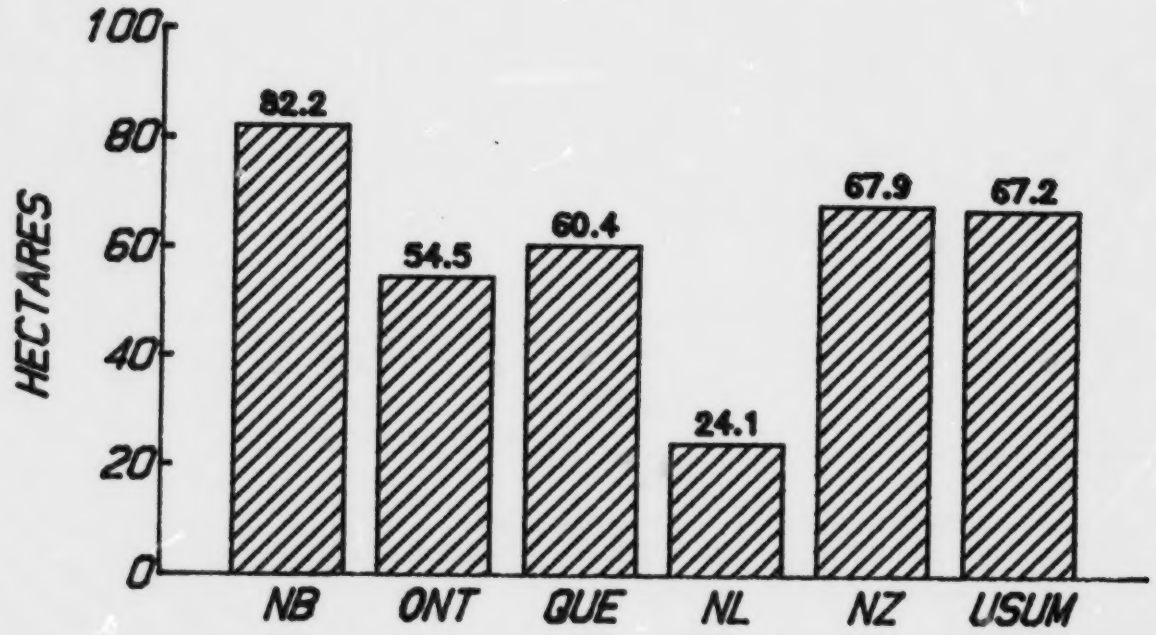
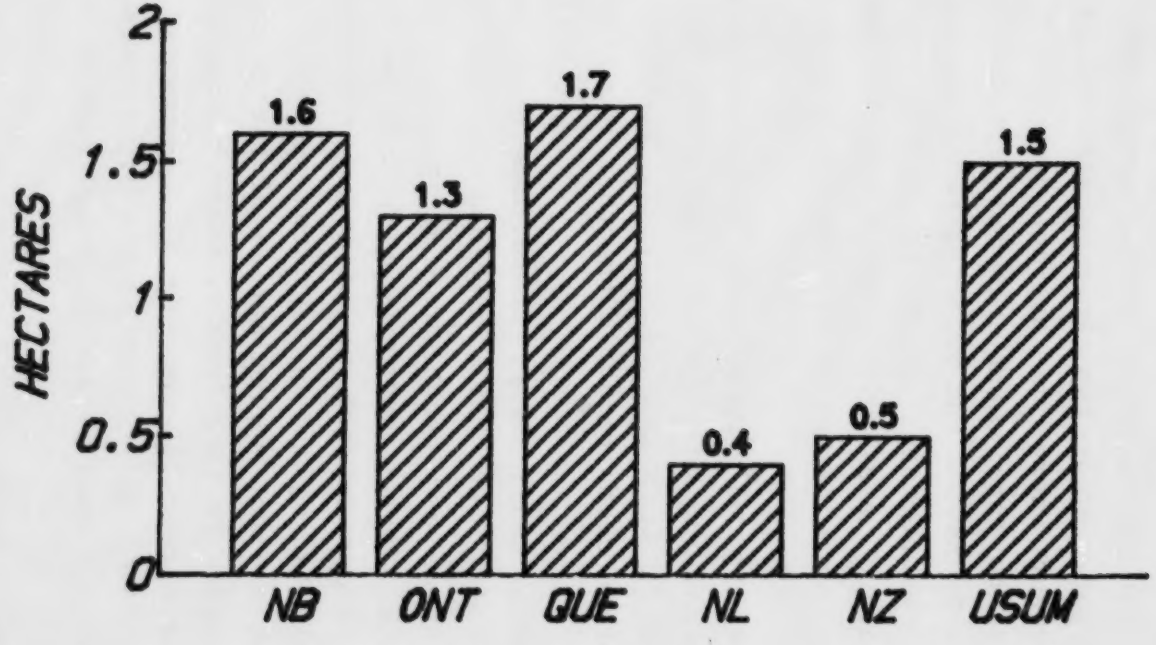


FIGURE 8
HECTARES OF FORAGE PER MILK COW



considered to yield less forage than normal pasture. Other hectarage includes buildings, woodlots, and areas set aside for other enterprises.

Farms in Canadian jurisdictions are typically larger than in the other locales except the Upper Midwest where the average was 172.7 hectares. Data on total land operated were unavailable for New Brunswick but reported hectarage is in excess of 90 hectares which is greater than for New Zealand and the Netherlands. New Zealand producers farmed on average about 76 hectares.

The typical Dutch farmer had a relatively small operation, only 26 hectares. The United States and Ontario had significant hectarage in non-forage crops relative to other locations.

Historically dairy operations have been forage based. We have combined forage crop area, pasture and rough grazing in order to estimate total forage hectares available to the typical producer in each jurisdiction, see Figure 7. By calculating forage hectares per milk cow we can get a rough approximation of the productivity of pasture in each locale, other things being equal. These calculations are also presented in Figure 8. We will comment on the significance of these results when we discuss supplementary feed use.

4.2.3 Labour Productivity

Measures of available labour in terms of person equivalents (PE) are presented in Table 7. In order to estimate labour productivity we have allocated these person equivalents between enterprises on the basis of revenue contribution. It was assumed that each allocated person works

2500 hours per year. These hours reflect all activities in support of the dairy operation including time spent growing feed for the dairy herd. Labour productivity was calculated by dividing hours of work allocated to the dairy enterprise by outputs of milk and butterfat. These findings are also shown in Table 7. Most but not all jurisdictions were able to provide estimates of task time and in the table we have reported their estimates of dairy related task time, not including management, as a percentage of our allocation.

The United States and Ontario had more people available to work in the dairy enterprise than other jurisdictions. New Brunswick and Ontario reported the highest numbers of paid labour hours. In New Brunswick hired labour provided about 38% of time spent with the dairy enterprise. In Ontario the percentage of paid labour hours was just under 30%. The Netherlands, New Zealand and Quebec utilized fewer persons in the dairy operation. In the Netherlands wages were only paid for about 7% of dairy related labour hours. Paid time accounted for a higher percentage of dairy task time in Quebec (about 14%) and New Zealand (just over 17%). See Figure 9.

The United States and Ontario used significantly more labour than other locales to produce a kilogram of butterfat, see Figure 10. The Upper Midwest producers required 0.61 hours of labour per kilogram while Ontario producers utilized 0.54 hours. The Netherlands employed the least amount of labour per kilogram of butterfat produced (0.19 hr/kg BF). New Zealand and Quebec engaged 0.29 labour hours per kilogram of

TABLE 7

LABOUR PRODUCTIVITY
1985

	Total Farm Labour (PE)	---- ALLOCATED DAIRY LABOUR ------ (PE)	(HR)	Per HL Milk (HR/HL)	Per Kg. Butterfat (HR/KG)	Reported Dairy Task Time % of Allocated
LOCALE						
New Brunswick	1.91	1.90	4,753	1.70	0.46	91.34%
Ontario	2.05	1.82	4,556	2.09	0.54	97.82%
Quebec	1.80	1.54	3,847	1.26	0.29	88.24%
Netherlands	1.65	1.62	4,059	0.94	0.19	71.32%
New Zealand	1.68	1.60	3,990	1.14	0.29	N/A
U.S.UpperMidW	2.81	2.32	5,800	2.31	0.61	67.24%

butterfat sold.

4.2.4 Supplementary Feed Use

Feed is the major input into milk production on a cost basis. Equipment, labour and storage costs should be lower if the milking herd obtains its nutrient requirements by grazing. Some supplementary feeding is necessary in all jurisdictions when pasture conditions can not provide adequate nutrition.

The research consultants were able to obtain detailed information on feed consumption for all jurisdictions. Feed was categorized as either a concentrate or forage. The concentrate category includes reported consumption of dairy rations, protein supplements and grains. Forage consumption includes hays, silages and straws.

These categories were further subdivided on the basis of whether the feed was purchased or homegrown. Quantities are reported in kilograms of dry matter to facilitate comparison within categories. Partial productivity measures were then calculated for each supplementary feed category. Our findings are reported in Tables 8, 9 and 10.

Overall measures of supplementary feed consumption are found in Table 8. New Brunswick, Quebec purchase a significant proportion on concentrates consumed by the dairy herd. The Netherlands purchases all concentrates fed to the herd. Ontario producers are able to grow about 74% of concentrate requirements. There is a minimal requirement for supplementary feeding of concentrates in New Zealand. In all jurisdictions with the exception of the

FIGURE 9
ALLOCATED LABOUR PER HECTOLITRE MILK

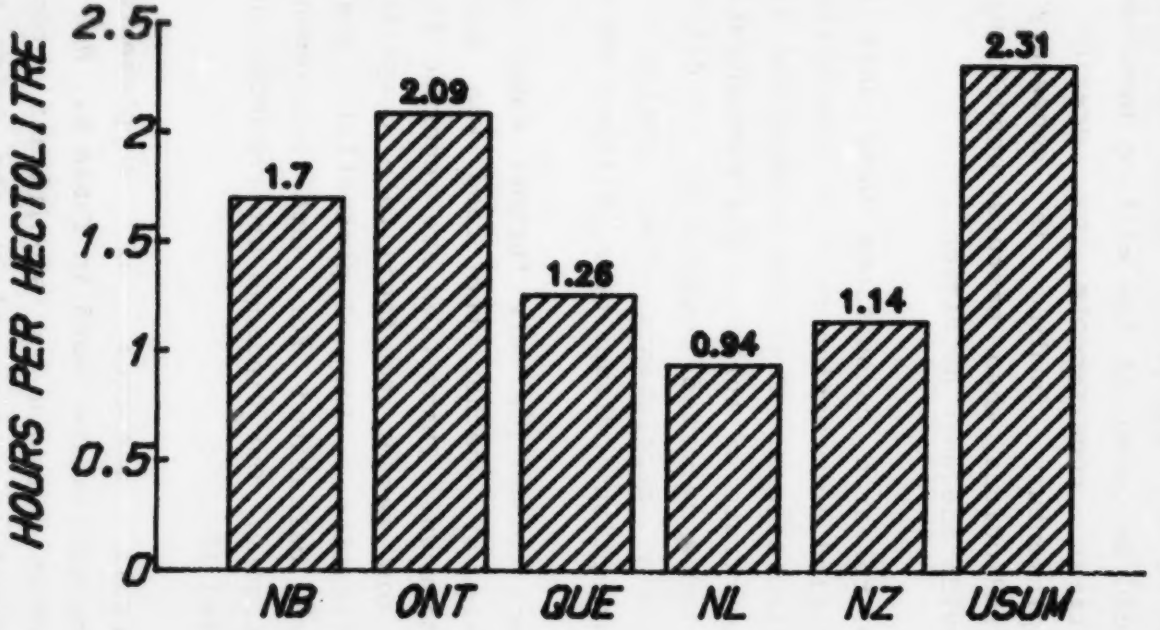


FIGURE 10
ALLOCATED LABOUR PER KILOGRAM BF SOLD

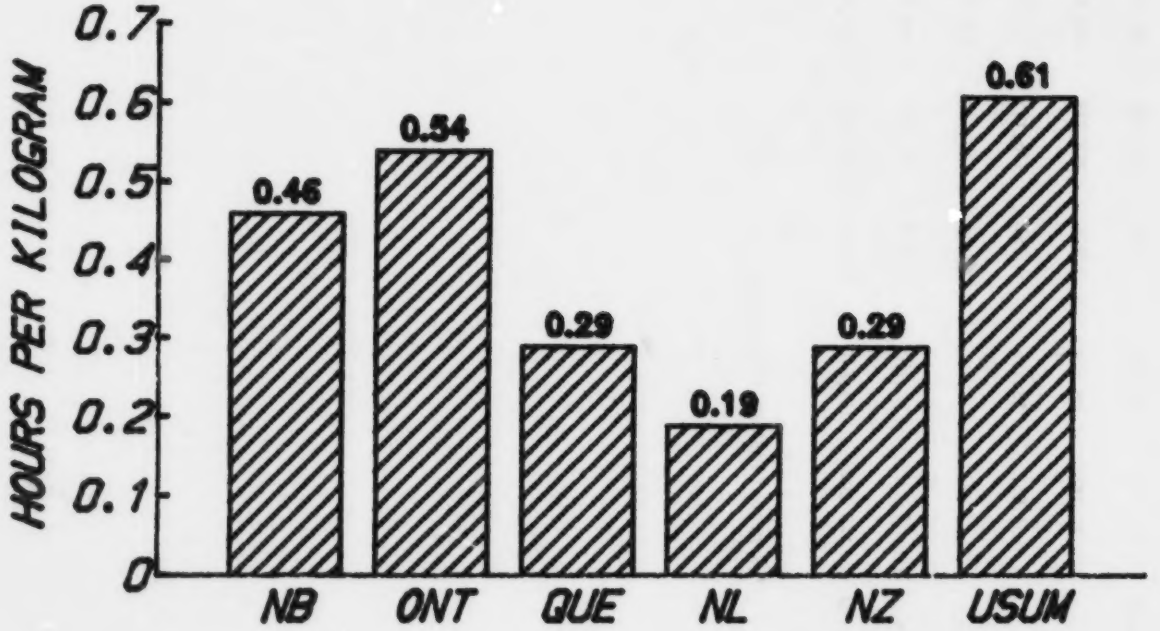


TABLE 8

SUPPLEMENTARY FEED FOR MILK HERD PLUS REPLACEMENTS
1985

(KgDm)	-- Concentrate -- Purch	Grown	---- Forage ---- Purch	Grown	Total	*REPORTED
LOCALE						
New Brunswick	135,488	11,081	196	234,334	381,099	5,287
Ontario	30,188	86,174	2,996	283,723	403,081	4,822
Quebec	54,952	18,155	4,257	136,195	213,559	N/A
Netherlands	124,434	0	48,600	102,500	275,534	106,000
New Zealand	1,892	1,755	9,547	51,625	64,819	N/A
U.S.UpperMidW	145,899	104,640	16,811	223,701	491,051	N/A

* Reported Pasture Contribution

TABLE 9

SUPPLEMENTARY FEED MEASURES PER HECTOLITRE
1985

(KgDM/HL)	-- Concentrate --		---- Forage ----		------	-------
Actual BF%	Purch	Grown	Purch	Grown	Total	*REPORTED
LOCALE						
New Brunswick	48.4	4.0	0.1	83.8	136.3	1.9
Ontario	13.8	39.5	1.4	129.9	184.6	2.2
Quebec	31.3	10.4	2.4	77.6	121.8	N/A
Netherlands	40.7	0.0	15.9	33.5	90.2	34.7
New Zealand	0.4	0.4	2.2	12.0	15.0	N/A
U.S. UpperMidW	58.10	41.60	6.70	89.0	195.40	N/A

* Reported Pasture Contribution

TABLE 10

SUPPLEMENTARY FEED PER KILOGRAM BUTTERFAT
1985

(KgDM/KgBF)	-- Concentrate --		---- Forage ----		------	-------
	Purch	Grown	Purch	Grown	Total	*REPORTED
LOCALE						
New Brunswick	13.13	1.07	0.02	22.70	36.92	0.51
Ontario	3.58	10.22	0.36	33.66	47.81	0.57
Quebec	8.51	2.81	0.66	21.10	33.08	N/A
Netherlands	9.35	0.00	3.65	7.70	20.70	7.96
New Zealand	0.09	0.08	0.44	2.37	2.97	N/A
U.S.UpperMidW	15.36	11.02	1.77	23.55	51.70	N/A

* Reported Pasture Contribution

Netherlands relatively minor amounts of forage are purchased. Approximately 32% of the required forage supplement in the Netherlands is purchased.

The extent to which pasture augments the nutrient requirements of the dairy herd is difficult to measure. In most instances the nutrient requirements of the dairy herd and contribution of supplementary feeds are estimated. It was assumed that nutrient requirements not met by supplementary feeding were provided by pasture. In Table 8 we have indicated estimates of pasture contribution where these have been reported.

The partial productivity measures for supplementary feed per hectolitre of milk sold are illustrated in Table 9. These figures do not take into account differences in butterfat content across jurisdictions. Findings for supplementary feed per kilogram of butterfat sold are presented in Table 10.

An average of 12.53 kilograms of dry matter per kilogram of butterfat was fed as concentrates. Supplementary feeding of concentrates per unit of butterfat sold in the United States was 2.1 times this average. New Brunswick and Ontario producers fed slightly more concentrates than the average of all six areas. The Dutch fed less than average amounts at 9.35 KgDm/KgBF. Supplemental feeding of concentrates was minimal in New Zealand on both an absolute and per unit of butterfat basis.

The average amount of supplementary forages fed was 19.66 kilograms of dry matter per kilogram of butterfat sold. The typical New Zealand

operator fed only 2.81 KgDm/KgBF of forages to augment grazing while Dutch farmers fed 11.35 KgDm/KgBF. Ontario producers who used 34.02 KgDm/KgBF relied most heavily on supplementary feeding. The United States (25.32 KgDm/KgBF), New Brunswick (22.72 KgDm/KgBF) and Quebec (21.76 KgDm/KgBF) farmers fed higher than average amounts of forage.

4.3 The Efficiency of Selected Inputs

In this section we explore the efficiency with which some of the main inputs into the dairy operation were employed. We impute a return to investment in cow capital and unpaid labour. The rate of return assigned is equal to the five year average real rate of return on long-term bonds in the home country. Purchased feed costs are also considered. Data limitations did not allow for a direct consideration of the efficiency of land inputs.

4.3.1 Efficiency of Investment in Dairy Herd

Assets held as dairy cattle could yield a return if invested elsewhere. By engaging in milk production the producer is foregoing the opportunity of making these alternative investments and is thus incurring an opportunity cost. We have imputed a cost of employing cows assets equal to the real rate of return the producer could expect if he had invested the same amount of capital in long-term bonds.

A valuation of dairy cow assets and the opportunity cost associated with holding these resources in milk production is found in Table

TABLE 11

OPPORTUNITY COST OF HOLDING COW ASSETS
1985

(Figures Are In 5yr Avg $Cdn)
(Opportunity Cost Is 5yr Avg Real Yield On Lt Govt.BONDS)

$Cdn by Locale	Cow Assets Total	Yearly Opportunity Cost	Per HL	Per KG. BF
New Brunswick	122,039	6,773	2.42	0.66
Ontario	70,213	3,897	1.78	0.46
Quebec	45,580	2,530	1.44	0.39
Netherlands	74,055	3,703	1.21	0.28
New Zealand	56,801	880	0.20	0.04
U.S. UpperMidWest	61,929	4,162	1.66	0.44

11. The average value of assets held as dairy cows was $71,769. Investment in the dairy herd ranged from a high of $122,039 in New Brunswick to a low of $45,580 in Quebec. Although New Zealand producers typically had larger dairy herds, the value of their holdings at $56,801, was relatively low.

Dutch and Ontario operators invested $70,213 and $74,055 respectively while United States operators had invested $61,929.

The typical cost of holding cow assets was $3,657. Costs ranged from a low of $880 in New Zealand to a high of $6,773 in New Brunswick. Dutch and Ontario producer costs at $3,703 and $3,897 respectively were slightly above average. Quebec costs at $2,530 were below average.

The efficiency of employing cow assets as a cost per unit output of milk and butterfat is also outlined in Table 11. Costs per hectolitre of milk output are not adjusted for butterfat content. Comparisons based on costs per kilogram of butterfat sold are more appropriate.

The average opportunity cost of employing cow assets was $0.38 per kilogram of butterfat sold. Costs were typically above this average in Canadian jurisdictions. New Brunswick producers had by far the highest costs at $0.66/KgBF. They were followed by Ontario and United States operators at $0.46/KgBF and $0.44/KgBF respectively. Dutch farmers at $0.28 had below average costs. New Zealand producers had an opportunity cost of holding cow assets of only $0.04/KgBF. This was significantly below the norm.

4.3.2 Labour Efficiency

Data on labour costs and efficiency are shown in Table 12 and Figure 11. Unpaid labour hours were estimated by subtracting reported paid hours from total hours assigned to the dairy enterprise. Wage rates were calculated by dividing expenditure on wages and benefits by paid hours. These rates were then used to value unpaid labour. Physical labour usage has been described in the section on labour productivity. In this section labour costs are considered in more detail.

Wage rates varied considerably across countries. Canadian jurisdictions paid wages in the $5.00/hr. to $6.00/hr. range. Dutch rates were considerably higher at $9.52/hr. The lowest wage rate of $3.63/hr. was found in New Zealand.

The average value of labour used in the dairy operation was $29,346. The United States had the highest labour expense at $38,742 followed by the Netherlands and New Brunswick at $38,537 and $31,095 respectively. Ontario and Quebecs' costs were lower at $25,151 and $20,547 respectively. New Zealand labour charges of $17,006 were significantly below average.

Labour efficiency was calculated as costs per hectolitre of milk and kilogram of butterfat sold. Our findings are given in Figure 12. If we exclude New Zealand the average labour cost per kilogram of butterfat sold was $3.23 and all jurisdictions except New Zealand and the U.S. Upper Midwest are within about 10% of this figure. The typical New Zealand enterprise with

TABLE 12

LABOUR EFFICIENCY
1985

LOCALE	Paid Labour Hours	Paid Labour $Cdn	Unpaid Hours Worked	Wage Rate $Cdn	Unpaid Labour $Cdn	TOTAL VALUE OF LABOUR INPUT $CDN	LABOUR COST/HL $CDN	LABOUR COST/KGBF $CDN
New Brunswick	1,651	$12,761	3,102	$5.91	$18,334	31,095	11.12	3.01
Ontario	1,320	7,480	3,236	5.46	17,670	25,151	11.52	2.98
Quebec	464	3,363	3,383	5.08	17,184	20,547	11.71	3.18
Netherlands	200	1,804	3,859	9.52	36,732	38,537	12.61	2.90
New Zealand	689	5,029	3,301	3.63	11,977	17,006	3.94	0.78
U.S.UpperMidWest	765	5,108	5,035	6.68	33,634	38,742	15.42	4.08

FIGURE 11
LABOUR COST PER HECTOLITRE MILK

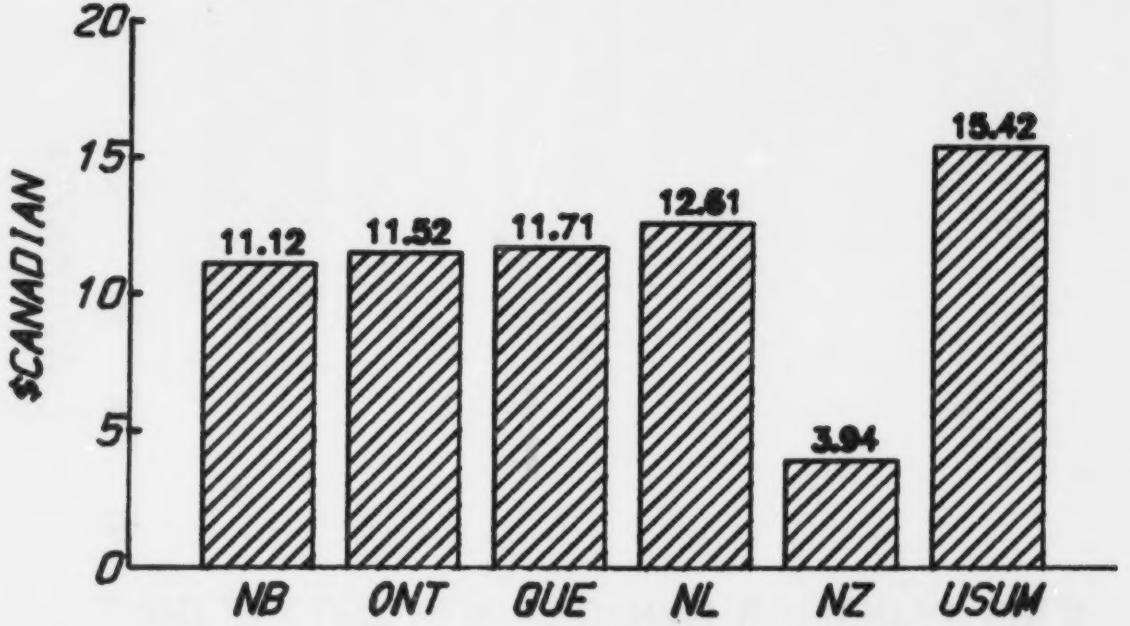
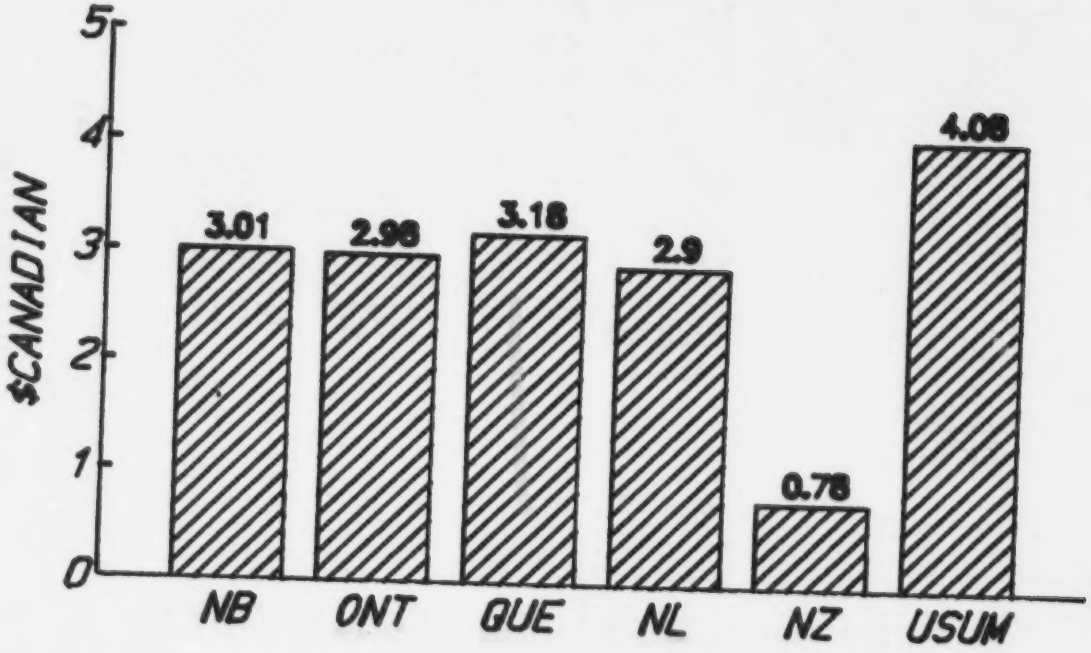


FIGURE 12
LABOUR COST PER KILOGRAM BUTTERFAT SOLD



labour costs of only $0.87/KgBF is much more efficient. The U.S. Upper Midwest labour cost per KgBF at $4.08/KgBF is relatively high.

4.3.3 Cost of Purchased Feed

The difficulty in estimating nutrient contribution from pasture precludes estimation of overall efficiency of feed conversion. Purchased feed costs are a measure of dependence on off-farm resources for this important input. Operators that are more dependent on off-farm sources are more vulnerable to price changes in feed markets.

Purchased feed costs per hectolitre of milk and kilogram of butterfat sold are shown in Table 13 and Figure 13. New Brunswick operators paid $3.71/KgBF for purchased feed which was the highest cost reported. Dutch farmers bought $2.75 worth of feed per kilogram of butterfat sold. Ontario producers were much less dependent on off-farm feed sources and spent only $1.18/KgBF.

U.S. Upper Midwest farmers spent $1.55/KgBF. New Zealand operators spent only $0.12 on purchased feed/KgBF.

4.4 Selected Revenues and Expenses for the Dairy Enterprise

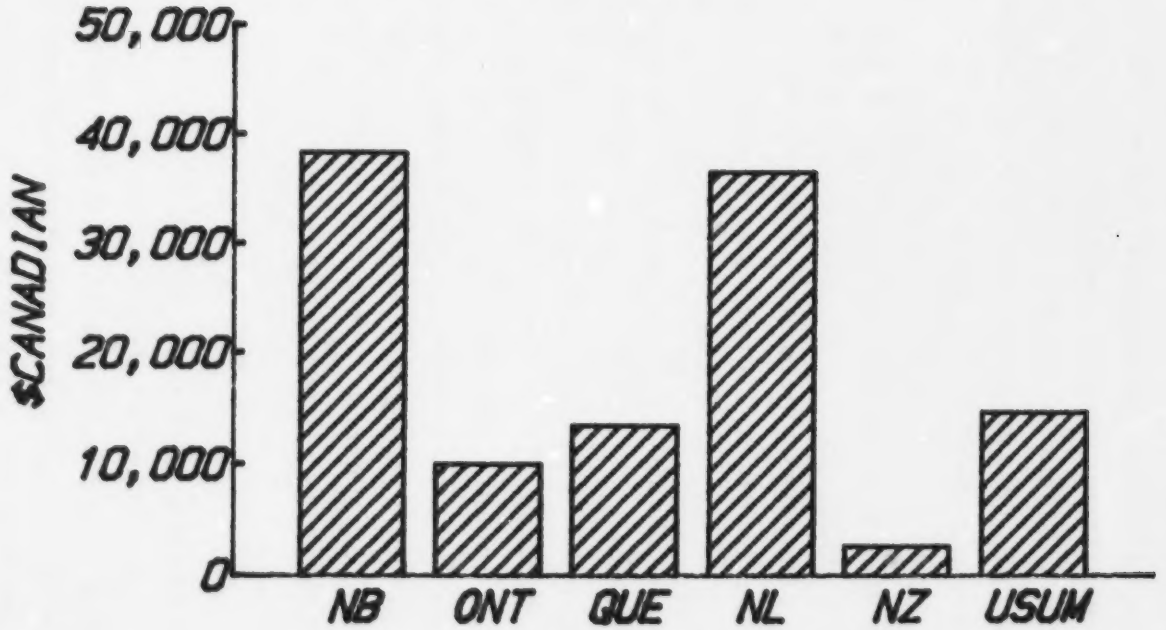
Having explored the productivity and efficiency of some of the more important inputs into milk production we now turn our attention to the aggregate enterprise. In Tables 14 and 15 we look at the dairy enterprise on a cash basis. Economic costs are incorporated in the next section.

TABLE 13

COSTS OF PURCHASED FEED
1985

LOCALE ($Cdn.)	Total	Per HL	Per Kg. BF
New Brunswick	$38,341	$13.71	$3.71
Ontario	$9,984	$4.57	$1.18
Quebec	$13,479	$7.68	$2.09
Netherlands	$36,550	$11.96	$2.75
New Zealand	$2,629	$0.61	$0.12
U.S.UpperMidWest	$14,714	$5.86	$1.55

FIGURE 13
TOTAL PURCHASED FEED COST



Revenues include all income from the sale of dairy herd outputs including direct subsidies and sales of dairy cattle. Only Canadian jurisdictions reported direct subsidy. New Brunswick dairy enterprises were the largest in revenue terms. New Zealand revenues are low relative to the physical quantities sold. Dutch sales of dairy livestock are relatively high given their herd size.

Expenses reported in Table 14 are those allocated to the dairy herd. In addition to high revenues New Brunswick producers also generated the highest level of overall expenses and overall net farm income. Given high indirect expenses, caution should still be exercised in drawing conclusions relating to specific expense components. Direct crop expenses for instance do not include the costs of equipment, land or labour inputs. Marketing expenses include levies and promotional costs. None were reported for New Zealand and Dutch operators. The net farm income of United States farmers, $4,138, was substantially lower than any of the other farmers.

Results are given on a per hectolitre milk and kilogram butterfat basis in Table 15 and Figures 14 and 15 respectively. Comparisons based on butterfat output are more appropriate than milk output due to variations in butterfat content. On a cash basis, New Brunswick producers had the highest net dairy income ($3.65/KgBF) followed closely by New Zealand ($3.50 /KgBF). Quebec had the next highest net dairy income at $2.90/KgBF followed by Ontario with $2.67/KgBF and Dutch operators were next with a cash return of

TABLE 14

SELECTED REVENUE/EXPENSE FIGURES
1985

Dairy Enterprise On An Accounting Basis
Milk Herd Plus Replacements

	N.B.	ONT	QUE	NEDER	N.Z.	U.S.(UMW)
DAIRY REVENUE $Cdn.						
Milk Sales	132,228	101,644	73,439	103,688	70,670	86,795
Direct Milk Subsidy	6,557	7,811	8,420	0	0	0
Other Milk Revenues	433	0	2,721	0	0	946
Tot Dairy Prod Revenue	139,218	109,455	84,580	103,688	70,670	87,741
Dairy Livestock Sales	13,004	15,051	10,347	24,815	16,448	10,215
Dairy Revenue	152,222	124,506	94,927	128,503	87,119	97,957
Inventory Change	1,112	-1,610	1,010	-1,183	0	0
TOTAL ENTERPRISE REVENUE	153,334	122,896	95,937	127,320	87,119	97,957
DAIRY EXPENSES $Cdn.						
Dairy Livestock Expense	58,502	30,950	31,849	46,157	12,088	25,626
Crop Expense	17,360	22,122	8,042	11,541	5,677	11,280
Indirect Expense	29,144	35,486	27,323	29,268	31,181	47,115
Interest	6,448	10,952	8,421	9,000	10,003	14,964
Land Rent	1,800	1,402	232	3,076	293	4,568
Wages	12,761	7,480	3,363	1,804	5,029	8,056
Marketing Expense	9,791	10,885	10,212	0	0	3,780
Total expenses Before Depreciation	105,006	88,558	67,214	86,967	48,945	84,021
Depreciation Expense	10,657	11,792	9,980	9,689	7,082	9,798
Total Enterprise Expense	115,663	100,351	77,194	96,656	56,027	93,818
Net Dairy Income Before Invnt & Deprn Adjustment	47,216	35,947	27,713	41,536	31,092	13,936
NET DAIRY INCOME	37,671	22,545	18,743	30,664	24,010	4,138

Table 15. Net Dairy Enterprise Income
By Hectolitre and Kg of Butterfat
Milk Herd Plus Replacements
1985

Per Farm ($Cdn.)	N.B.	ONT	QUE	NEDER	N.Z.	US UPPER MIDWEST
Dairy Revenues	153,334.00	122,896.00	95,937.00	127,320.00	87,119.00	97,957.00
Dairy Expenses	115,663.00	100,351.00	77,194.00	96,656.00	56,027.00	93,818.00
Net Dairy Income	37,671.00	22,545.00	18,743.00	30,664.00	31,092.00	13,936.00

Per HL ($Cdn.)	N.B.	ONT	QUE	NEDER	N.Z.	US UPPER MIDWEST
Hectolitres Sold	2,797.00	2,184.00	1,754.00	3,056.00	4,316.00	2,513.00
Dairy Revenues	54.82	56.27	54.70	41.66	20.19	38.98
Dairy Expenses	41.35	45.95	44.01	31.63	12.98	37.33
Net Dairy Income	13.47	10.32	10.69	10.03	7.20	5.55

Per Kg BF ($Cdn.)	N.B.	ONT	QUE	NEDER	N.Z.	US UPPER MIDWEST
Kilograms Butterfat Sold	10,321.00	8,430.00	6,456.00	13,310.00	8,888.00	9,499.00
Dairy Revenues	14.86	14.58	14.86	9.57	9.80	10.31
Dairy Expenses	11.21	11.90	11.96	7.26	6.30	9.88
Net Dairy Income	3.65	2.67	2.90	2.30	3.50	1.47

FIGURE 14
DAIRY INTERPRISE, REVENUE, EXPENSES
AND NET INCOME PER HECTOLITRE

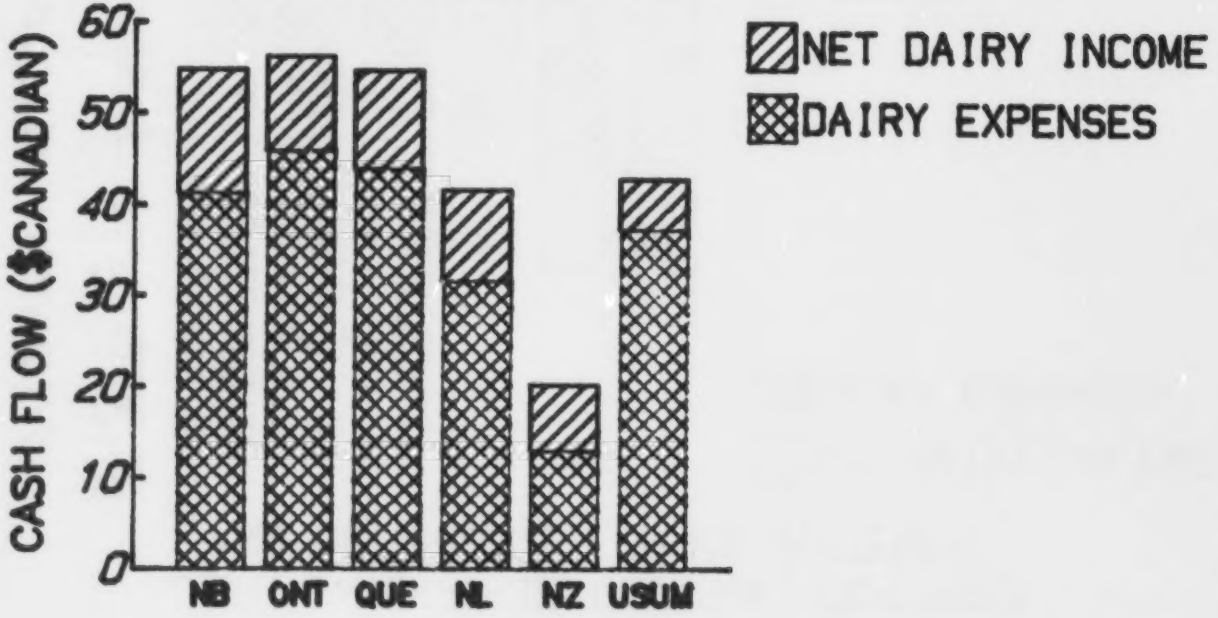
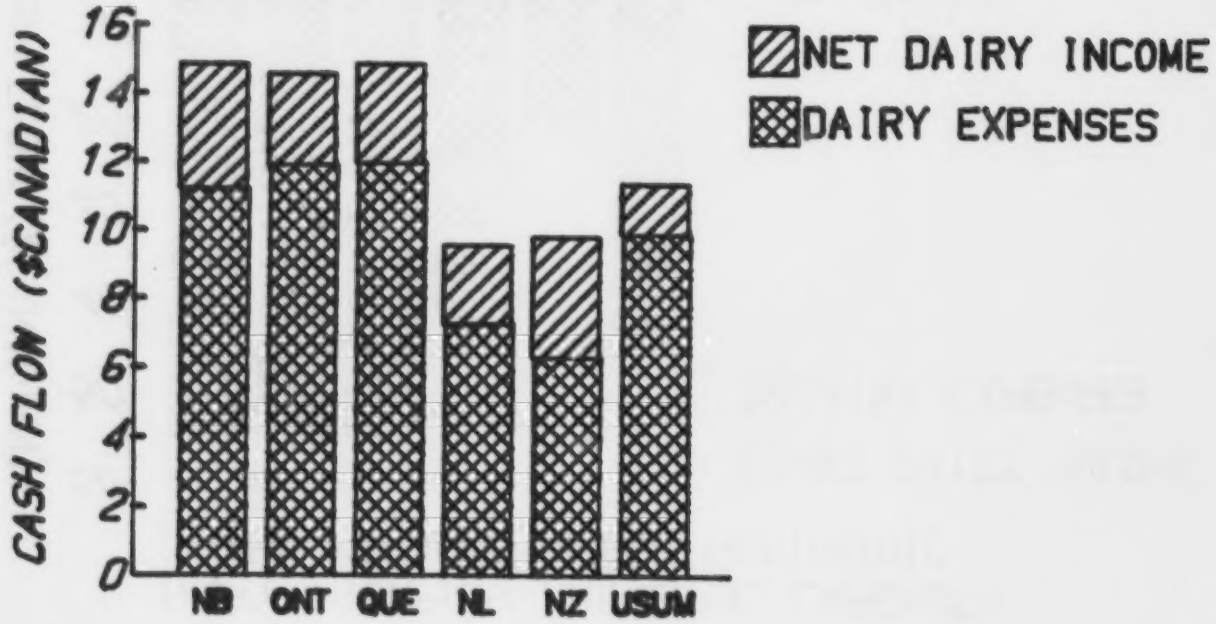


FIGURE 15
DAIRY ENTERPRISE, REVENUE, EXPENSES
AND NET INCOME PER KG BUTTERFAT



$2.30/KgBF. The United States producers had by far the lowest net dairy income of only $1.47/KgBF.

4.5 Economic Costs and the Total Costs of Producing Milk

4.5.1 The Opportunity Cost of Employing Dairy Assets

The opportunity cost of investing in the dairy herd is calculated in Table 16. In order to estimate a cost of employing assets in milk production the research consultant has multiplied the market value of dairy assets by a real rate of interest. In order to assess the relative efficiency with which these assets are employed results are also summarized on a per hectolitre of milk and per kilogram of butterfat basis.

Since we have valued assets at market no allowance for depreciation is made. Quota is treated as a dairy asset. Given recent performance in land prices we have chosen not to treat land as a special asset. We have not made allowances for working capital requirements nor have we estimated income receivables.

In our calculations we have applied an interest rate equal to the five year average real rate of return on long-term bonds in the respective home country. This rate of return was 6.72% in the United States, 5.55% in Canada, 5.00% in the Netherlands and 1.55% in New Zealand.

Average dairy asset value was $438,060. The value of resources employed in milk production ranged from a low of $319,055 in the United States to a high of $612,565 in Ontario. The

TABLE 16

OPPORTUNITY COST OF EMPLOYING DAIRY ASSETS
1985

LOCALE	DAIRY ASSETS --- PER FARM --- Market Value	Opportunity Costs	OPPORTUNITY COSTS --DAIRY ASSETS-- Per HL	Per Kg BF
New Brunswick	$566,431	$31,437	$11.24	$3.05
Ontario	612,565	33,997	15.57	4.03
Quebec	343,068	19,040	10.86	2.95
Netherlands	396,806	19,840	6.49	1.49
New Zealand	390,432	6,052	1.40	0.28
U.S. UpperMidWest	319,055	21,440	8.53	2.26

opportunity cost of Upper Midwest holding these assets was also highest in Ontario ($33,997) and ranged to a low of $6,052 in New Zealand. The average cost of employing capital in milk production was $21,968, see Figure 16.

The average opportunity cost of employing dairy assets as shown in Figure 17, was $2.34 per kilogram of butterfat sold. Costs ranged from a low of $0.28/KgBF in New Zealand to a high of $4.03/KgBF in Ontario. New Brunswick had the next highest cost at $3.05/KgBF followed by Quebec with a cost of $2.95/KgBF and the United States Upper Midwest at $2.26/KgBF.

4.6 The Total Cost of Producing Milk

Partial factor productivity measures cannot be added because they are measured in different units. Partial factor efficiency measures can, however, be aggregated because they are all valued in dollars. They may be summed to estimate the cost of production.

Our calculations of total costs of production are reported in Table 17. We have added cash costs less interest payments and depreciation to our imputed return to unpaid labour and the opportunity cost of employing dairy assets. No return to management is assessed. Efficiency measures are presented as total costs per hectolitre of milk and kilogram of butterfat sold. Calculations of total cost per hectolitre of milk have not been corrected for butterfat content. Costs of production on a butterfat basis are comparable and a direct measure of relative efficiency.

FIGURE 16
OPPORTUNITY COST OF DAIRY ASSETS PER HL

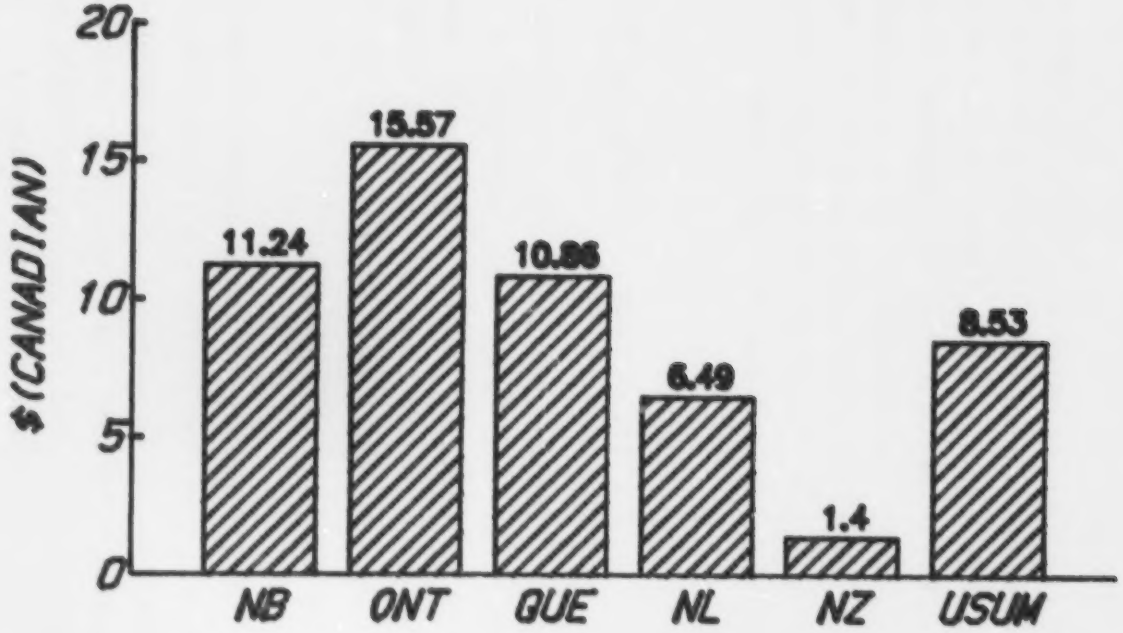


FIGURE 17
OPPORTUNITY COST OF DAIRY ASSETS
PER KG BF

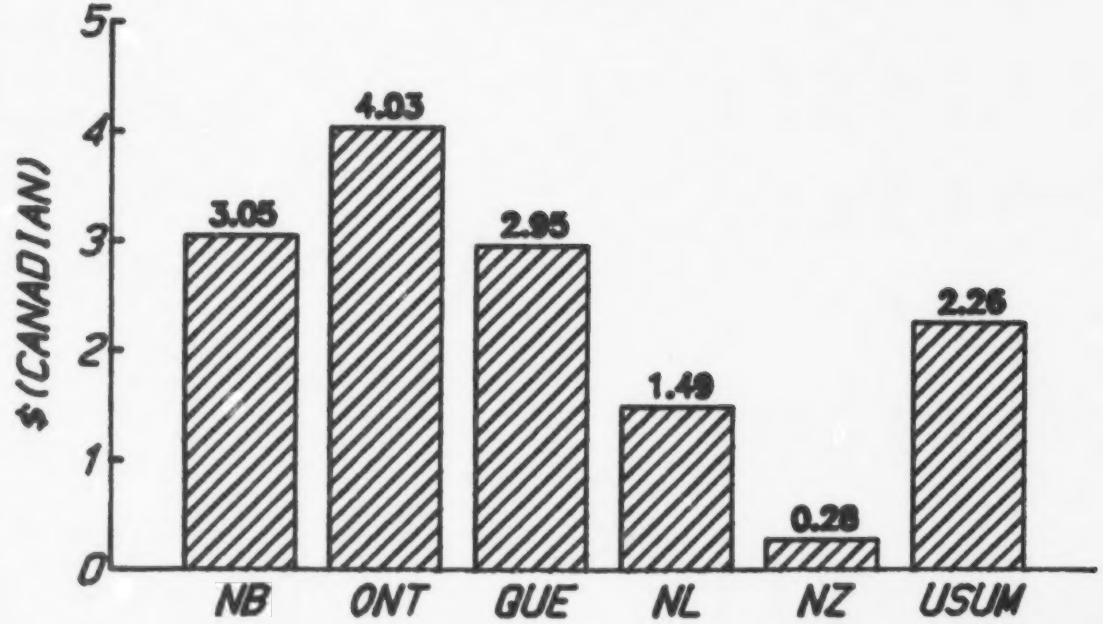


TABLE 17

Total Cost of Producing Milk Per Farm
1985

Locale	Cash Costs	Return to Unpaid Labour	Opport Cost of Dairy Assets	Total Product Costs (TPC)	TPC Per HL	TPC Per KG BF
New Brunswick	$98,566	$18,334	$31,457	$148,357	$53.04	$14.37
Ontario	77,613	17,670	33,997	129,280	59.19	15.34
Quebec	58,798	17,184	19,040	95,022	54.17	14.72
Netherlands	77,967	36,732	19,840	134,539	44.02	10.11
New Zealand	38,942	11,977	6,052	56,971	13.20	2.61
U.S. UpperMidW	69,057	33,634	21,440	124,131	49.40	13.07

Ontario had the highest cost of production ($15.34/KgBF) followed by Quebec ($14.72/KgBF) and New Brunswick ($14.37/KgBF). Costs in the United States and Netherlands were $13.07 and $10.11/KgBF respectively. New Zealand costs of production were lowest at only $2.61/KgBF. The simple average cost of production was $11.70/KgBF. Results are presented as an index of total cost of production below. In calculating the index the average cost of production is equal to 100.

Locale	Index of Total Production Cost
New Brunswick	123
Ontario	131
Quebec	126
U.S. Upper Midwest	112
Netherlands	86
New Zealand	22

5.0 DISCUSSION

Data limitations are still the greatest deterrent to doing effective cross country comparisons. The New Zealand Milk Board simply had not collected the information necessary at the sample level to calculate most productivity measures of interest. The U.K. data were only collected for costs relating directly to the milking herd. The replacement herd was not included in their surveys because its output was not milk. These data constraints limited the scope of our analysis.

We are confident that the input-output accounting approach is appropriate for the comparisons made. The farms included in this study were all highly specialized dairy operations. Under these circumstances the effect of allocative errors is minimized. Differences in estimation procedures at the survey data level may have been significant. For example the estimated opportunity costs of assets may have been influenced by differences in the way Quebec and Ontario calculate the market value of assets.

Most locations in this study had some form of restriction on the sale of milk. In Canadian jurisdictions, quotas are in place and may be traded. The right to sell milk is explicitly valued as a balance sheet item. Production quotas were also in place in the Netherlands and a moratorium on new supply was in effect in New Zealand during 1985. Data were not available to determine the effect of these measures on the value of other dairy assets in these locations.

This study demonstrates the extent to which single productivity or measures of scale considered in isolation may be misleading. Canadian farms are relatively large in revenue and asset terms but small in terms of physical levels of outputs. High milk sales per milk cow did not prove to be the best indicator of competitiveness. It follows that if emphasis is placed on enhancing a single factor productivity measure, operational choices may be made that do not lead to the most efficient overall allocation of resources.

Differences in production technology have had an important impact on the findings. The way milk is produced in New Zealand differs significantly from Canadian jurisdictions. Canadian producers have integrated fluid and industrial milk production whereas in New Zealand these products tend to be produced on separate farms. Canadian producers are encouraged to maintain a consistent level of production throughout the year. In New Zealand industrial milk is produced only during the pasture season. No doubt these differences in production practices and technologies have cost implications for the processing sector. Such differences also limit the efficacy of a production function approach to inter-country productivity comparisons.

Macroeconomic factors have had an important impact on our results. In 1985 New Zealand's economy was experiencing severe inflationary pressures. Farmers' real costs of borrowing were actually negative. In this study some smoothing of data was done in order to overcome some of the distortions that arise from short-term currency or interest rate fluctuations. This procedure may have been inappropriate in the sense that producers in fact operated with short-term distortions in place.

Distortions in feed markets may also impact on the study findings. Ontario's reliance on home grown feed is a disadvantage when feeds may be purchased at less than production costs. The competitiveness of Dutch farmers would be significantly reduced if feed prices were to rise.

6.0 CONCLUSIONS

1. In terms of milk sales and butterfat production Canadian farms are smaller than those in the Netherlands and New Zealand but similar to the United States farmers studied.

2. Canadian factor inputs were generally less productive than those in the Netherlands and New Zealand and when local costs are assumed are less efficient.

3. Canadian milk production is significantly less competitive than those in the Netherlands or New Zealand and slightly less competitive than the United States Upper Midwest.

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APPENDIX 1

DATA SOURCES

NEW BRUNSWICK

Survey Methodology

Sample Description and Methodology

The New Brunswick Dairy Business Analysis Accounting Project (NBDAAP) is a cooperate project of the New Brunswick Milk Marketing Board, The Canadian Dairy Commission and the New Brunswick Department of Agriculture. The sample of farms for the project was randomly selected from producers licensed with the New Brunswick Milk Marketing Board. All farmers enrolled in the project are provided with a systematic farm recording system (Homestead). Farms are visited seven to ten times a year by project representatives who record financial transactions, related physical production and management data.

Table A1

County	# of Producers Participating	% of Total Producers	% Milk Production
Albert	0	0.00	0.00
Carleton	1	2.00	1.90
Charlotte	0	0.00	0.00
Goucester	0	0.00	0.00
Kent	0	0.00	0.00
Kings	10	6.36	6.45
Queens	1	11.11	22.52
Madawaska	4	18.18	21.90
Northumberland	1	5.26	3.12
Restigouche	2	6.90	3.94
Sudbury	0	0.00	0.00
Victoria	1	4.76	6.55
Westmorland	5	7.58	10.05
York	7	10.00	11.30
TOTAL	32	6.29	7.18

Eligibility

Producers licensed by the New Brunswick Milk Marketing Board and who shipped milk were eligible for inclusion in the sample. Sample characteristics for 1985 are given in the following table.

Table A2. 1985 Sample Characteristics

	Herd Size # of Cows HD	Milk Sales Litres* (Hl.)	Milk Sales /Cow in Litres	Total Farm Man** Equivalents	Hrs/Hl. of 3.6 Milk
Average	51.48	2,939.58	5,543.76	1.91	1.24
Standard Error	21.18	1,572.99	1,204.34	1.18	.98
Range - Low	25.00	582.77	1,965.59	.32	.61
- High	137.00	9,335.27	6,943.83	6.07	5.76

* 3.6 kilograms B.F. per hl fat corrected milk.
** one man-equivalent equals 3,000 man hours of labour available per year.

Special Sample Considerations

None

Sample Limitations

None Apparent

ONTARIO

Survey Methodology

Sample Description and Methodology

The Ontario Dairy Farm Accounting Project (ODFAP) is a cooperative project of the Ontario Milk Marketing Board, Agriculture Canada, the Canadian Dairy Commission, the University of Guelph and the Ontario Ministry of Agriculture and Food. A stratified random sample of farms for the project was selected from producers licensed with the Ontario Milk Marketing Board. All farmers enrolled in the project are provided with a systematic farm recording system (Canfarm). Farms are visited up to seven times a year by project representatives who assist producers in recording of financial transactions and relevant production information.

The survey sample is intended to represent milk producers in Southern Ontario. The sample structure in the 1985 project year displayed the following distribution.

Table A3. ODFAP 1985 Sample Structure

Region	Number Enrolled
Region 1 - Essex, Kent, Lambton, Elgin, Middlesex, Norfolk.	9
Region 2 - Brant, Oxford, Waterloo, Perth, Huron	33
Region 3 - Wellington, Dufferin, Bruce, Grey, Simcoe	21
Region 4 - Niagara, Haldimand, Wentworth, Halton, Peel, York, Ontario, Durham, Prince Edward, Northumberland.	21
Region 5 - Victoria, Peterborough, Hastings, Lennox & Addington, Frontenac, Lanark, Leeds	18
Region 6 - Carleton, Grenville, Dundas, Stormont, Glengarry, Prescott, Russell	29
Total	131

Eligibility

Producers licensed by the Ontario Milk Marketing Board and who shipped milk are eligible for inclusion in the sample. Sample characteristics for 1985 are given in the following table.

Table A4. 1985 Sample Characteristics

	Herd Size # Cows	Milk Sales*	Milk Sales* per/cow	Tillable Hectares	Total*** Man Equiv-alents	Age of Farm Operators
	hd.	litres	litres	Ha.	M.E.	Yrs.
131 Farms						
Average	42.6	235,315	5,393	94.4	2.1	45.5
Standard Error	1.9	12,205	102	5.2	.1	.9
Range-Low	12.0	43,288	1,913	21.0	.98	24.0
-High	143.5	959,710	8,345	419.0	4.58	86.0

Note: The low and high range figures reported for the different variables in the above table do not necessarily relate to the same farm.

* 3.6 kilograms per hectolitre fat-corrected milk.
** One man-equivalent equals 3,000 man-hours of labour available per year.

Special Sample Consideration

None.

Sample Limitations

Northern Ontario producers are not represented. (4.8% of provincial shipments in 84/85)

QUEBEC

Survey Methodology

Sample Description and Methodology

Data are collected by groupe de recherche en économie et politique agricoles, université Laval. The survey is a cooperative project of the Canadian Dairy Commission, la fédération des producteurs de lait du Québec and l'université Laval. The sample was randomly selected. The sample is stratified geographically, by size and by type of operation. Structural characteristics are outlined in Table A5.

Table A5. Distribution of Survey Participants

	1st Strata 441 hl+ 1,322 hl	2nd Strata 1,323 hl+ 2,645 hl	3rd Strata 2,646 hl and up	TOTAL
	Partici-pants	Partici-pants	Partici-pants	Partici-pants
Cote du Sud et Bas-St-Laurent(1)				
Fluid	10			10
Industrial	12			12
Saguenay-Lac St-Jean(1)				
Fluid	5			5
Industrial	2			2
Sherbrooke-Quebec,Beauce				
Fluid	7	13	2	22
Industrial	24	4		28
St-Hycinthe,St-Jean, Valleyfield				
Fluid	7	9	8	24
Industrial	5	3		8
Joliette,Mauricie Laurentides,Nicolet				
Fluid	3	15	2	20
Industrial	14	7		21
TOTAL				
Fluid	32	37	12	81
Industrial	57	14		71

(1) One strata only

Special Sample Consideration

None

NETHERLANDS

Survey Methodology

Survey Description and Methodology

Sample data used in this study was collected and analyzed by the Landbouw-Economisch Instituutlei at The Hague, The Netherlands. The Institute is supported by the Dutch Ministry of Agriculture and Fisheries. LEI has farm account networks established on a random sample basis for various agricultural enterprises including dairy. LEI makes up the farm accounts independently on the basis of documents, biweekly information sheets provided by the operator and data from trading and processing firms, herdbook and animal health associations. The network is intended to provide a survey of the entire Dutch farming sector.

Eligibility

For this analysis data from specialist dairy operations (operations deriving more than 80% of revenue from dairy activities) was gathered. The analysis is based on a random sample of 422 farms from a population of approximately 34,000 eligible dairy enterprises.

Special Sample Considerations

LEI has reported that few producers are in the mainly dairy strata, (defined as 66-80% of revenue derived from dairy activities).

Because quotas on milk production were introduced by the EEC results for the 1984/85 dairy year were considered to be somewhat distorted. We have used results for the 1985/86 dairy year in order to minimize consequences arising out of the introduction of quotas.

Sample Limitations

The farm account network excludes farms below a certain size. LEI reports that such farms represent only minor shares of total agricultural land use and production. (Approximately 5% of total)

NEW ZEALAND

Survey Methodology

Sample and Description Methodology

Sample data used in this study was collected by the Agricultural Economics Research Unit of Lincoln College, Unviersity of Canterbury, Canterbury, New Zealand. A random sample of eligible factory dairy producers was selected and on-farm interviews conducted by the researchers. The main sources of information were the farmer and his annual farm accounts.

The survey area was in the South Auckland area, south of Manurewa to Pokeno. Most of the surveyed factory supply dairy farms were in the districts Manukau Peninsula, Aka Aka and Paparimu.

Eligibility

To be eligible for selection the following criteria needed to be met:

i. The farm engaged no sharemilker.
ii. The farm received at least 75 per cent of gross revenue from milk sales and related dairy activity.

Table A6. South Auckland Dairy Farm
Population and Sample Numbers - 1984-85

	South Auckland Factory Supply Dairy Farms
Total Number of Dairy Farms in South Auckland	404
Less the Number of Farms with Sharemilkers and Factory Supply Farms with Small Town Milk Quotas	163
Less the Number of Farms with Less than 75% of Revenue from Dairy Activities	63
Number of Farms Eligible to Survey	178
Number of Farms Surveyed	31

The estimated number of farms with less than 75% of revenue from dairy activities for the factory supply farms was based on the known proportion for town milk farms.

Special Sample Considerations

Complete sample data is not available for New Zealand as a whole. The South Auckland area, however, is one of the primary producing areas. South Auckland in 1985 reported 45.5% of New Zealand dairy cows in milk and 46.2% of Milk fat processed. The South Auckland dairy farmers surveyed in the AERU study are of similar size to New Zealand averages as reported by the New Zealand Milk

Board in their "Economics Survey of Factory Supply Dairy Farms in New Zealand 1984-85". The comparison is made in Table A7 below.

Table A7. Selected Comparisons
NZDB New Zealand and AERU South Auckland

	Effective Area (ha)	1984-85 Herd Size (Milk Cows)	Milk-fat(Kg)	Gross Farm Income $	Net $
South Auckland (AERU)	66.13	136	21802	109245	36504
New Zealand (NZDB)	67.00	136	20848	103085	28048

Sample Limitations

The sample excludes herds operated by sharemilkers and holders of small town milk quotas which represented approximately 40% of farmers supplying some factory supply milk. Approximately 15% of farms supplying some factory supply milk were not eligible to survey because less than 75% of revenue was derived from dairy activities. Despite the apparent comparability of South Auckland dairy farmers in the AERU study with NZDB results for the whole of New Zealand caution should be exercised in ascribing South Auckland results to New Zealand as a whole. The AERU study was utilized because physical measures such as labour usage, feed usage and stock reconciliations were available to support the financial data for participants.

ENGLAND AND WALES

Survey Methodology

Sample Description and Methodology

The National Investigation into the Economics of Milk Production in England and Wales is sponsored jointly by the Milk Marketing Board of England and Wales and the Ministry of Agriculture, Fisheries and Food. Sample data are collected and analyzed by eight University departments and one College of Agriculture in collaboration with the sponsoring bodies. The survey is based on a stratified random sample of farms reflecting the regional distribution of dairy herds in England and Wales. It is intended that survey data represent the entire dairy sector in these two countries.

Eligibility Requirements for Participants

Sample participants are specialist dairy producers (66% of Standard Gross margin derived from Dairy activities) and mainly dairy producers (>33% of Standard Gross margin derived from dairy activities and dairy is largest margin). The distribution of herds in the sample is given in Table A8 below.

Special Sample Consideration

The Milk Marketing Board has reported that over 80% of production is represented by sample participants.

The introduction of quotas in April 1984 distorted results for the 1984-85 dairy year. Data for the 1985-86 dairy year is used in this study.

Table A8. Distribution of Herds in the Survey and in England and Wales by Herd Size Groups, 1985/86

Herd Size (Cows)	Number in Sample	%	Number in England and Wales (at June 1985)	%
10 - 29.9	41	11.8	7246	18.9
30 - 39.9	37	10.6	5575	14.5
40 - 49.9	28	8.0	3824	9.9
50 - 59.9	44	12.6	4172	10.9
60 - 69.9	22	6.3	3443	9.0
70 - 99.9	67	19.3	7215	18.8
100 - 149.9	63	18.1	4728	12.2
150 - 199.9	16	4.6	1176	3.0
200+	30	8.7	1058	2.8
ALL HERDS	348	100.0	38437	100.0

Sample Limitations

Whole farm data are not collected. Data collection relates only to the milking herd proper and does not include activities related to the replacement herd. Minimum eligible herd size is 10 milking cows.

UNITED STATES

Upper Midwest

Sample Description Methodology

Sample data used in this study was collected and analyzed by the United States Department of Agriculture. The U.S.D.A. Farm Costs and Returns Survey data for dairy are collected for a random sample of dairy producers approximately once every five years. While the survey sample is intended to represent dairy producers across the U.S. statistically significant results are available by region. This study includes results from only the Upper Midwest. States represented in this area are Michigan, Minnesota, Wisconsin and South Dakota.

Eligibility Requirements for Participants

The FCRS covers all farm operators in the 48 contiguous states who sold $1,000 worth of farm products the previous year or who had $1,000 of expenses.

Special Sample Consideration

Acreages devoted to crop production are imputed from crop production and yield information. The overall survey has 2,200 participants representing approximately 85% of U.S. milk production.

Sample Limitations

None apparent.

APPENDIX 2

A COMPARISON OF QUEBEC AND ENGLAND AND WALES

Dairy Enterprise defined as the milking herd only
and excludes the replacement enterprise

Data from the National Inquiry Into the Economics of Milk Production were not sufficiently detailed to allow for inter-country comparisons on a milk herd plus replacement basis. In this appendix we offer comparisons between England and Wales and Quebec assuming that the dairy enterprise consistes of the milk herd only.

MILKING ENTERPRISE

	Quebec,	England and Wales
SELECTED REVENUES		
Milk Sales (including direct subsidy)	$81,867	$105,776
SELECTED EXPENSES		
Feed Purchases	$12,717	$28,848
OUTPUTS		
Milk Sales	1,754 hl	3,490 hl
Butterfat Sales	6,456 Kg	13,855 Kg
Butterfat % wt/vol	3.68%	3.97%
PRODUCTIVITY MEASURES		
Cow Productivity		
Number of Milk Cows	36.0	66.9
Number of Replacements	31.0 GLU	32.3 GLU
Milk Sales/Cow	48.72 hl	52.18 hl
Butterfat/cow	179 Kg	207Kg

LAND UTILIZATION

Land Operated	111.7 ha	74.3 ha
Non Forage	18.0 ha	17.2 ha
Forage Crops	40.4 hg	1.6 ha
Pasture	20.0 ha	50.0 ha
Rough Grazing	N/A	1.1 ha
Other	33.4 ha	4.4 ha
Forage Hectares	60.4 ha	52.7 ha
Forage Hectares/cow	1.7 ha/cow	0.8 ha/cow

LABOUR PRODUCTIVITY

Allocated Milk Herd Labour	2,857 hrs	2,528 hrs
Paid Hours	388(includes crop labour)	974(excludes forage)
Unpaid Hours	2,469 ditto	1,554 ditto
Labour Hours/Hl	1.6 hr/hl	0.7 hr/hl
Labour Hours/KgBF	0.4 hr/KgBF	0.2 hr/kgBF

SUPPLEMENTARY FEED FOR MILK HERD

Purchased Concentrates	48,846 Kg Dm	88,086 KgDm
per hl	27.8 KgDm/hl	25.2 KgDm/hl
per Kg BF	7.6 KgDm/KgBF	6.4 KgDm/KgBF
Home Grown Concentrates	15,762 KgDm	5,676 KgDm
per hl	9.0 KgDm/hl	1.6 KgDm/hl
per KgBF	2.4 KgDm/KgBF	0.4 KgDm/KgBF
Purchased Forage	3,164 KgDm	12,452 KgDm
per hl	1.8 KgDm/hl	3.6 KgDm/hl
per KgBF	0.5 KgDm/KgBF	0.9 KgDm/KgBF
Homegrown Forage	101,129 KgDm	122,260 KgDm
per hl	57.5 KgDm/hl	35.0 KgDm/hl
per KgBF	15.7 KgDm/KgBF	8.8 KgDm/KgBF

EFFICIENCY MEASURES

Opportunity Cost of Holding Cow Assets

Value of Milk Herd	$31,029	$64,568
Opportunity Cost	$1,722	$3,222
per hl	$0.98	$0.92
per KgBF	$0.27	$0.23

Labour Efficiency

Paid Labour cost	$1,971	$6,185
Unpaid Labour cost	$12,543	$9,868
Total Labour Cost	$14,514	$16,053
per hl	$8.27/hl	$4.60/hl
per KgBF	$2.25/KgBF	$1.16/KgBF

Cost of Purchased Feed

Purchased Feed	$12,717	$28,848
per hl	$7.25/hl	$8.27/hl
per KgBF	$1.97/KgBF	$2.08/KgBF

In the absence of complete information about assets and liabilities for the NIEMP sample it is not possible to derive an opportunity cost of employing dairy assets. We were unable to derive a useful comparison of overall efficiency.

LIST OF WORKING PAPERS PUBLISHED IN 1989

No. 1 The International Competitive Status of Canada's Milk Production Sector. Rick Phillips, James White and Peter Stonehouse. January 1989.

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